MICROS:

A PRIMER FOR PUBLIC LIBRARIES

The Ontario Ministry of Citizenship and Culture

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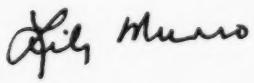
FOREWORD

On September 18, 1985, I had the pleasure of officially opening Libraries 2000: A Futures Symposium in Toronto. That symposium provided a challenging look into the future of our society. One common theme of the symposium was the impact of technology on all aspects of our society. Computer technology in particular is having a major impact on libraries. While large public libraries in Ontario have been using computer technology over the last ten years, the technology has only now evolved to the point where smaller libraries can participate in the computer age.

My ministry has therefore developed a comprehensive new program to assist small libraries with the implementation of new technology. The "Automation Program for Small Libraries" (APSL) will fund training sessions across the province, provide publications related to the use of microcomputers in libraries, and assist with funding feasibility studies and the purchase of computer hardware and software.

The publication of this microcomputer "primer" for libraries is part of APSL and is designed to provide assistance to staff with little prior knowledge of microcomputers. It is hoped that the information contained in this publication about understanding microcomputer hardware, undertaking a needs analysis, selecting a vendor and implementing a system will be of assistance to public library boards and staff contemplating the purchase of a microcomputer.



Lily Munro
Minister

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0. OVERVIEW

This guide has been developed to assist smaller Ontario cultural organizations in their decision-making process regarding the purchase of microcomputers. It provides management with a framework within which to move in a logical manner. The framework as described is divided into four major components. The organization moves through each of these stages, from initial consideration, through a needs analysis study, through the selection and purchase of an automated system, to the implementation of that system. An automated system can consist of anything from a single microcomputer with a single use — e.g. word processing — to an integrated system using several microcomputers for a variety of functions. The process does not presume that once an organization embarks on an automation study, implementation of an automated system will be the end result. The framework itself provides certain check-points where the organization can decide if it will proceed further towards automation or stop. The reader should note that this guide is intended as an introduction to the automation process. A minimum of technical language has been used. Should the reader be interested in a more sophisticated automated environment, the publication Yes or No — What you Need to Know About Automation: A Decision System for Ontario Libraries would be of value.

The first four chapters in this guide present different stages in the automation process. The fifth chapter provides a series of walkthrough exercises pertinent to particular cultural organizations.

In **Chapter One — Initial Steps**, the organization's appointed project leader should examine the pressures to automate, including the successful implementation of microcomputers in other organizations, the recommendations of management, and staff interest in improving present operations. In order to deal with these pressures, the organization must also become familiar with computer technology, e.g. **hardware, software, input, output**, etc. Finally, the project leader would look at the organization's environment to determine whether it is practical to automate.

In **Chapter Two — Needs Analysis**, the organization examines its present operations for the purpose of determining whether its functions could benefit from automation. A basic needs assessment takes place where the functions of the organization's operations, if any, which might benefit from automation, are isolated. These functions are then analysed in terms of activity, volume, size of records, in areas such as bookkeeping, data base management, statistics, etc. This information is required by vendors in order for them to determine, first, whether they have pertinent software packages, and secondly, whether they can supply the hardware to support these packages. Software availability is of primary importance.

In **Chapter Three — Selecting the Vendor**, the organization begins dealing with the microcomputer marketplace. This involves identifying qualified vendors, requesting and securing information from them in writing, determining the cost of the microcomputer, evaluating vendor responses, and negotiating a contract with the chosen vendor. It is during this process that the organization may have to look at alternatives to its original concepts of the microcomputer.

In **Chapter Four — Implementation**, the organization proceeds with the practical implementation of the selected microcomputer system. This stage of the automation process requires close liaison between the organization and the vendor and, in fact, the steps and their timing in implementation are governed to a great degree by clauses in the contract. Both parties are concerned that the system be up and running with as few difficulties as possible. The organization will be involved in a number of vital tasks during this period. Major tasks include: preparation of the physical site for the computer installation, systems acceptance testing, the conversion of data from the manual to automated system, the training of staff, and public relations.

Upon completion of implementation and after the system has operated for a period of time, the organization should perform a post implementation review. This serves to identify how well the automation project has met its objectives and, if problems are apparent, to recommend ways for corrective action.

Chapter Five — Worksheets provides a number of exercises and checklists to be reviewed by cultural organizations wishing to consider the installation of microcomputers. It also provides a list of literature/sources which would be of further assistance for those Ontario cultural organizations that are considering becoming involved in the automation process.

Appendix A is an alphabetical listing of computer definitions. Throughout the text, those technical words in bold type can be found, and defined, in this glossary.

1. INITIAL STEPS

1.1 SHOULD WE AUTOMATE?

The computer revolution is a fact of life in the nineteen eighties. Although promised since the sixties, automation is really only beginning to have a significant impact on many industries, businesses and institutions and on the personal and work life of the individual. There are a number of vendors currently active in the marketplace offering products which can be installed and used by cultural organizations. The technology itself is changing in that the future appears to indicate less expensive systems will be available for a variety of applications, thus enabling smaller and smaller institutions to consider automation without incurring prohibitive costs.

A parallel phenomenon to the computer revolution in the nineteen eighties is the hard fact of fiscal restraint. All organizations are finding it increasingly difficult to operate effectively in these circumstances and their funding authorities are encouraging more efficient and cost-effective operations.

As a result of these two factors, the increasing availability of technology and the decreasing availability of funds, automation is viewed more and more as a potential means of raising service levels and staff productivity in various organizations while at the same time containing escalating costs.

Cultural organizations can expect pressure to automate at least some of their operations in the next decade. This pressure can come from a variety of sources including the following:

- Perceived Internal Needs — Automation may be viewed from within as a potential means of eliminating certain problem areas in the running of the organization and/or providing enhanced service levels to users.
- Example — Other organizations or municipal departments within the community have successfully automated.
- Peer Pressure — Colleagues and associates have automated portions of their operation and are sharing their expertise with the rest of the community.
- Automation Hype — Advertising and marketing of computer technology is widespread and compelling.
- Enthusiasts — Every institution has its enthusiasts, whether staff, board members or users; some of these have a widespread knowledge of computer applications.
- Governing and Funding Authorities — Requests for an organization to consider automation for reasons of efficiency and cost-effectiveness and/or to provide better services may come from the powers above.

The rapid growth in the use of microcomputers leads prospective first-time buyers to draw opposite conclusions. Some people respond with: "I'd better buy one and learn how to use it as soon as possible." Others take the view that "things are changing so rapidly, I had better wait and see."

Both points of view seem to have merit. Hardware and software are going to improve, but there are benefits to be gained by automating today.

You could "wait and see" permanently. The technology will not stop changing and improving. By delaying the purchase of a microcomputer simply on the grounds that anything you buy today will be obsolete tomorrow is to miss the point. There are two overriding questions: Will you benefit from the equipment that is available now, and will the equipment serve your purposes? If the answer to both questions is "yes", then it does not matter that more advanced models are coming along all the time. The use of microcomputer equipment can be justified for at least three years, after which a "trade up" to more sophisticated equipment usually occurs. Therefore, the purchase of a microcomputer need not be postponed on the grounds of potential obsolescence. You may delay the purchase on other grounds — your preliminary investigation may show that a microcomputer is just not practical for your organization right now.

Don't worry about the technique of using a microcomputer. Just ask someone who was born in 1900 what they thought of telephones in 1910, or automobiles in 1920, or airplanes in 1930, or tabulating equipment in 1940, or television in 1950, or computers in 1960.

1.2 WHAT IS A COMPUTER?

A computer, in a word, is a tool. It is a machine that aids our memories by storing information (numbers, words, and facts) in its own memory. It carries out tasks that we want it to perform by moving information in and out of its memory and processing it in some way.

1. INITIAL STEPS

A computer's chief characteristics are these:

- It will do only what it is told to do.
- It uses programs — sets of instructions written in computer language to make the computer carry out the tasks we want it to perform; they are known as software.
- It carries out computations by means of arithmetic instructions (adding, subtracting, etc.) and logical instructions (shifting, comparing and testing the value of numbers and letters).
- It can utilize data in a variety of ways, depending on the order of the instructions it receives.
- It sends messages to and receives messages from input/output devices, i.e., equipment attached to it which enables you to communicate with the computer, such as a printer.
- It carries out the same instructions over and over again, without error or complaint, and at high speed.

Although the classes overlap, the main classes of general purpose computers are mainframes, minicomputers and microcomputers.

Mainframes

Mainframes are computers with very large memories and sophisticated processing units that are used, for example, by banks and airlines, as well as by government departments. Mainframes are used for jobs that require very large amounts of information to be stored and retrieved, and for jobs that require a lot of information to be entered and manipulated in some way. Mainframes can be used simultaneously by many different users. They invariably require specialists to run them and cost $250,000 or more.

Minicomputers

Minicomputers are physically smaller than mainframes and have less memory and processing power. Minicomputers may cost anywhere from $20,000 to more than $500,000 and may require at least one full-time specialist (for the larger minicomputers) to install and run them. Many municipalities in the 5–25,000 population range have installed a minicomputer to handle all their accounting requirements. Generally speaking, the purchase price of the software ($20,000 to $50,000 or more) includes the cost of getting the programs installed and working on the computer. Existing staff are trained to operate the system; specialist data processing staff are usually not employed.

Microcomputers

Microcomputers are the smallest computers; they may be divided into two categories:

- Home microcomputers — intended for "non-business" purposes, that can be used for playing games and little else, costing from under $1,000 for the **hardware** and basic **software**. They can handle only tiny filing systems.
- Office microcomputers (sometimes called small business computers) — designed with the capacity to handle functional activities such as tax billing as well as acting as personal productivity tools when used for such purposes as word processing. Their cost is in the range of $1,000 to $20,000.

1.2.1 BASIC ELEMENTS OF A MICROCOMPUTER SYSTEM

Strictly speaking, a microcomputer comprises only the "brain" (called the processor) which executes the instructions, plus the memory in which information is stored. But in order for the computer to carry out the tasks the user wants it to perform, the user must feed into it a program that contains instructions on how to carry out that task. The instructions must be written in a language the computer can understand. Also the user needs a means of communicating information, or data, and instructions to the computer, and the computer needs a means of communicating to the user what it is doing, as well as the results of its efforts — hence the need for **input output devices**.

Input/output devices and other equipment attached to the computer are referred to as **peripherals**, e.g., **keyboard, printer**. The computer itself, its peripherals, and the programs are referred to collectively as the computer system.

1.2.2 BITS AND BYTES

Eight **bits** are used in most microcomputers to represent a character. Eight bits constitute a **byte**. Therefore, a byte is equal to a character (letter, number or symbol). For most purposes, a byte is the smallest piece of data on which the computer operates. A byte can be thought of as the equivalent of a keystroke on a typewriter.

1.2.3 HARDWARE

The Central Processing Unit (CPU)

The **CPU**, or central processing unit, is the most vital piece of hardware in a computer. It carries out, or executes, instructions which enable the computer to do the variety of tasks that users require. The speed of the CPU is important in determining processing requirements. For example, an 8 **bit** CPU processes one character or **byte** at a time; in 1985, a 16 bit machine, processing 2 bytes at a time, is the standard. 32 bit microprocessors are becoming more readily available.

Memory and Memory-Related Devices

The memory is the computer's storehouse for information. Its size, or capacity (how much it can hold), has a very important bearing on what a computer can be used for. The technology of computer memory is progressing rapidly and improvements are constantly being made.

A computer generally has three kinds of memory: permanent memory, called **R**ead **O**nly **M**emory, or **ROM**; temporary memory, called **R**andom **A**ccess **M**emory, or **RAM**; and mass storage memory. ROM and RAM can hold only limited amounts of information. This problem is overcome by using magnetic disks or tapes for mass storage of programs and data.

How Memory Size is Measured

The size of a computer's memory — RAM, ROM or mass storage — is measured in bytes. Bytes are usually counted in thousands or millions. The units are:

kilobyte = **K** byte (KB) = 1,024 bytes
megabyte = **M** byte (MB) = 1,024 × 1,024 = 1,048,376 bytes

Thus a K byte is roughly equal to 1,000 bytes and an M byte is roughly one million bytes. Since one byte is needed to represent a character, 1 K byte of memory will hold only about 1,000 characters, 64 KB of memory will hold 65,536 characters. This may seem a lot, but an average page of text, for example, could easily contain 3,000 characters. Thus 64 KB of memory would store only about 22 pages of text.

ROM

Read **O**nly **M**emory is used by the CPU and cannot be altered. ROM stores the start-up and control routines that the CPU uses constantly. ROM is "non-volatile"; whether the computer is turned on or off, the contents of ROM do not disappear.

RAM

Random **A**ccess **M**emory, often called the main memory, is the memory you will be concerned with when you are considering the size of memory your computer will need. RAM allows instructions or data to be put into it, taken out, or simply read. The programs or data stored on **disks, diskettes** or **magnetic tape** are loaded into RAM. The CPU goes to RAM to get the instructions or data on which to operate. It can go directly to any location in RAM, which is why it is called *random access memory*. When the computer is finished the operation, it sends the data back to RAM. RAM can store any type of data or instructions, and is therefore very flexible. It is also very fast.

The contents of most types of RAM are volatile: when the computer is turned off they disappear. Program instructions and data can always be put back into RAM the next time you use the computer because they are stored on disks, diskettes or magnetic tape. However, the results of any processing the computer has done will be lost, unless they have been transferred out of RAM, to magnetic tape or disks, before the computer is turned off. Hence, beware of power stoppages!

Office computers need at least 64 K bytes of RAM. Many popular word processing packages require more than 64 KB, and some spreadsheet packages require at least 192 KB. New machines have 512 KB or more of RAM.

Mass Storage Devices

The space available for storing data or instructions in RAM is limited. This problem is overcome by using mass storage devices that are physically separate from the computer, i.e., disks, diskettes and magnetic tape. All three are used for storing large amounts of data, as well as programs. Because it is much slower, but much cheaper, magnetic tape is used mainly for back-up purposes.

- **"Floppies"**

  Floppy disks, or diskettes, look much like 45-rpm phonograph records. They are now commonly available in two sizes: 8" (floppies) and 5 ¼" (mini-

floppies). They are not rigid but are housed in a stiff plastic envelope to protect them. A 5 1/4" floppy diskette can typically store from 120 to 400,000 bytes. An 8" floppy may store up to 1 million bytes, or 1 megabyte (1 MB). A group of micro-floppies, between 3" and 3.9", is now available. They have storage capacities as great or greater than those of the 5 1/4" mini-floppies, and are reported by the manufacturers to be much more reliable.

A floppy disk must be loaded into the computer's disk drive unit when you want to use the data or programs stored on it. When you have finished using the floppy you take it out of the disk drive.

- **Hard Disks**

  Made of aluminum with an iron oxide magnetic surface, hard disks (often called **Winchester** disks) are, as their name suggests, rigid. A hard disk, unlike a floppy, cannot usually be removed from the computer, although removable hard disks are now becoming available.

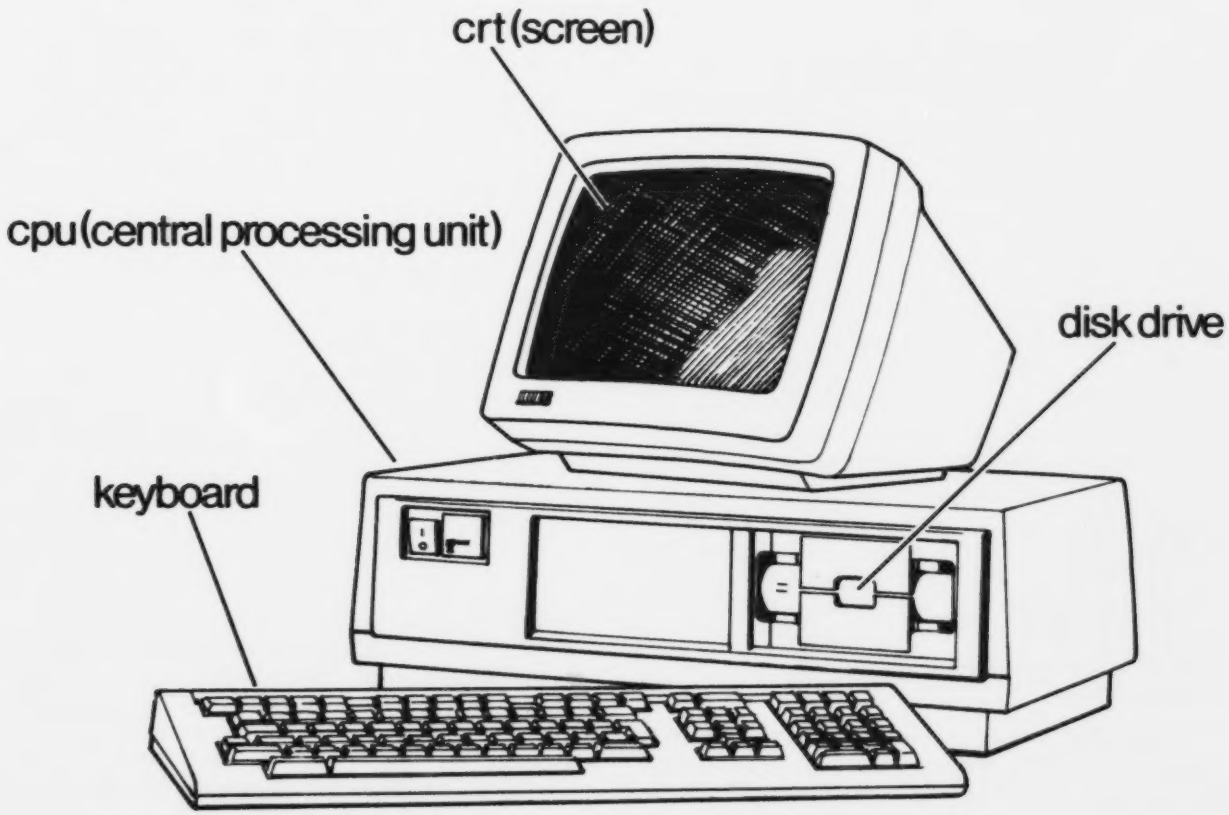
  A hard disk stores far more than a floppy disk of the same size — typically between 5 and 20 million bytes (5–20 MB). It is much faster at transferring data to the RAM. It is also much more expensive than a floppy disk, but the price is coming down.

- **Videodiscs**

  Soon information retrieval will benefit from video-disc technology. Videodiscs can store up to 8 hundred million characters of data on one disc, including both text and graphics.

1.2.4. INPUT/OUTPUT DEVICES

Input is an item, information or instruction that you want to be able to enter into the computer. Output is a report or result that you want the computer to be able to perform; hard copy refers to paper; online refers to a terminal display.



1. INITIAL STEPS

The input/output devices are what we see and use — the **keyboard**, the **screen**, and the **printer**. There is another device, too — the **modem**, which enables one computer to communicate with another via telephone lines.

The Keyboard

The computer's keyboard resembles the keyboard of a typewriter, but it has additional, special-purpose keys. The keyboard may be a separate unit, or it may be built into the housing of the computer. By depressing a key, you send a coded signal to the computer, thus gaining access to its CPU and memory. You can type, or key in, data (letters, numbers or symbols) as well as instructions, and they will appear on the screen of the CRT. You can also choose particular programs from menus (lists of different functions displayed on the screen) by keying in the appropriate response. See Illustration I.

The CRT

The cathode ray tube (CRT) is the part of the computer that looks like your television set. The CRT is also called a VDT (video display terminal) or a monitor. Like the keyboard, it may be a separate unit, or it may be built as part of a unit which contains the keyboard and the **micro-processor**. Its screen displays data or instructions that you are entering, layouts for the data, the output resulting from the computer's efforts, or error messages and prompts to help you do the right thing. Some CRTs lend themselves more readily to colour and graphics than do others. See Illustration II.

Printers

A printer is a robot typist that produces the computer output on paper. The two basic types of printer are the impact, or "letter-quality", printer and the dot-matrix printer. A letter-quality printer prints a character — a whole letter, number or symbol — as a fully formed impression in a single stroke, exactly as a character is printed by a typewriter. But instead of a letter hammer or type ball that typewriters use, the printer uses a print wheel (often called a daisy wheel) or a thimble.

Letter-quality printers are slow, printing about 30 to 55 characters per second (cps). They are also expensive to buy and to operate. However, their printing looks better than that produced by a dot matrix printer.

The dot matrix printer deposits a pattern of dots on the paper, in the shape of a character. These printers are three to eight times faster than letter-quality printers and are less expensive to buy and to operate. The quality of their output can be improved to resemble letter-quality printing, but the means of doing so slows down the printer's speed. They do a better job than letter-quality printers of producing graphics, and they tend to require less servicing. Top quality laser printers are also now available. However, they are very expensive.

Light pens (as used by cashiers in supermarkets) and touch screens (data is input by touching the CRT instead of the keyboard) are also input devices.

Networking

A microcomputer system can be self-sufficient, and it can operate without being linked to any other computer, i.e., it is a standalone system. However, one of the real strengths of a microcomputer is that it can be linked to other computers, or even to other office equipment. Linking one computer to another enables them to communicate. They can pass messages (electronic mail) and information (from other computers' data bases) and can share processing tasks (distributed networks).

One way of linking computers is by means of a **modem** (**mo**dulator/**dem**odulator). A modem is a device that allows data to be sent via telephone lines to another computer. See Illustration III.

A built-in modem is certainly a "natural" feature of portable and transportable microcomputers.

For those smaller cultural organizations which are physically located near other municipal users of microcomputers, consideration could be given to **Local Area Networks (LANS)**. Local area networking allows a variety of electronic devices (telephones, word processors, microcomputers, minicomputers, etc.) to share processing capabilities. However, it has yet to be proved that LANS are as effective as originally thought.

1.2.5 SOFTWARE

Besides the hardware, you have to obtain software. "**Software**" refers to the programs written to run on the hardware, that tell the computer what to do. These programs are generally stored on disks. They are loaded into the computer **RAM**, where the **CPU** can access the instructions. The computer will not function

without software. Software can be divided into two broad categories: **operating software** and **applications software**.

Operating software is the collective name for the class of programs that *control the operations* of the computer. These programs are produced by the computer manufacturer and control the execution of other programs, as well as the internal functioning of the computer. Applications software is the collective name for the class of programs that *apply* the computer to your needs, e.g. accounting programs, word processing programs, etc.

As part of the operating software, there are over 40 operating systems in use today. Although most computers run under their own operating system, a growing number are able to run under more than one of the available operating systems. If you choose one of the latter microcomputer systems, it is important to understand the features and limitations of the operating system with regard to the intended application. Applications packages are created to run under specific operating systems.

Some of the terms you might run across are:

- CP/M
- CP/M 86
- MS DOS
- UNIX

A ***package*** refers to an application program that is sold as a complete, self-contained unit, comprising a thoroughly tested program or series of programs ready for use as well as a comprehensive manual explaining how to use the package. The program instructs the computer to carry out the tasks that the user wants done. A program sold as a package should be usable by the purchaser without major modifications being necessary.

Program packages, (also called software packages or application packages) can be divided into two major types: ***generic* packages**, and ***functional* packages**.

Generic packages are packaged programs that can be used by anyone in *any* organization — regardless of industry, or size of organization, or the experience of the computer user. Also the tasks that generic programs perform are not restricted to any particular part of an organization. For example, the production of documents (letters, memos, reports, etc.) occurs right across an organization. So a generic package such as a word processing package could be useful to *anyone* who has to produce letters or reports. These packages enable individuals to improve their own *productivity* in carrying out their own work.

In contrast with generic packages, a *functional package* refers to a series of computer programs that perform the tasks connected with a particular organizational *function* — for example, accounting or payroll. (All of these are corporate functions.)

Functional packages are usually designed for a particular industry. Accounting practices among different industries or sectors of the economy vary quite a lot. An accounting package designed for commercial business therefore probably *won't* meet the requirements of a non-profit organization without being heavily modified.

Here are some common generic packages.

Spreadsheet Packages

An electronic spreadsheet package turns the microcomputer's screen into the equivalent of a very large sheet of paper with columns and rows, like the spreadsheets used for accounting or bookkeeping. If you want to change one of the numbers to see how it will affect the rest of the budget, the computer automatically changes all the related numbers. e.g. VISICALC

Word Processing Packages

Word processing packages turn the microcomputer into a typewriter that processes words electronically. These packages not only enable the microcomputer to produce your letters, reports, minutes and so on, but they also allow you to rearrange paragraphs, change the wording, and reformat the appearance of the text, all automatically. Some word processing packages can compile lists, create indexes and even check spelling. Instead of writing your annual report from scratch, you can merely update/rearrange or add new information whenever you wish. e.g. WORDSTAR, MULTIMATE

Data Base Utilities, Report Generators, File Managers and Inquiry Packages

These packages enable you to set up computer files, search the file contents quickly, display information, update or correct it, rearrange it in a different order, and print it in report form. You have immediate access to all the stored information. e.g. dBASE III

Graphics

Graphics programs convert numbers into pictorial form — pie charts, bar graphs, and so on. The "pictures" are often much easier to grasp than a table of numbers. They may be displayed on the CRT or printed out, or both. Graphics programs require a specially equipped dot matrix printer or a **plotter**. e.g. VISICALC, LOTUS

Communications

Communication packages enable computers to communicate with each other over telephone lines via a modem. The linking of one computer to another makes it possible to send and receive information. e.g. SMARTCOM, PC TALK

Today there are thousands of applications programs available for microcomputer systems. Several general software directories are available (see Section 5.9) and every major microcomputer vendor can provide lists of software available for the specific vendor hardware. For functional applications suitable to cultural organization needs, see Section 5.8.

1.3 PRACTICAL CONSIDERATIONS

The following is a list of questions to help you to determine whether your organization will be able to handle the planning, implementation and operation of a microcomputer. These questions should be asked for any application you are considering.

1.3.1 Have you talked to other people who have knowledge of this application? These could include municipal officials, data processing professionals, business people, computer science educators, or people from other cultural organizations that have automated.

1.3.2 Have you read appropriate literature or attended conferences in order to acquaint yourself with microcomputers and their applications?

1.3.3 Are you prepared to make some changes to your current methods and procedures to fit a computer system?

1.3.4 Are you prepared to accept the responsibility for the implementation of this application? It will take time and effort. Can you establish an automation committee to assist you?

1.3.5 Can your staff operate the system once it is running? For instance, they require typing skills and should be familiar with the processes to be computerized.

1.3.6 Is your staff amenable to this change? Will they participate in training? Can they afford the time required for training? For example, it may take 30 hours or more to become proficient in a word processing application.

1.3.7 Can you afford allocating staff to loading your present manual records such as mailing lists?

1.3.8 Is your physical site suitable for a microcomputer, i.e., is your electrical supply adequate? Do you have the space and furniture to accommodate a computer?

1.3.9 Are your records suitable for loading into a computer? That is, are they current, accurate and complete, or does some remedial work have to be done?

Once you can answer most of these questions in the affirmative, you are ready to look at those functions in your organization that you feel should be automated.

2. NEEDS ANALYSIS

2.1 FUNCTIONS OF A CULTURAL ORGANIZATION

A basic step, when considering automation, is the preparation of a needs assessment. This assessment looks at the total operation with a view to determining various strengths and weaknesses and isolating problem areas or those areas that could benefit from change.

STEP 1 First of all, divide your operation into its component parts — for example, administration, public service, publications, and statistics.

STEP 2 Look at each part and determine what functions have to be performed. For example, under administration, possible functions could include such things as:

- Budget and financial reports
- Grant applications
- Bookkeeping, etc.

A sample listing is provided in Section 5.1.

STEP 3 Gather available data for each function as to inputs, processes and outputs:

- Inputs — includes expenditures usually associated with staffing levels, supplies, service contracts, etc.
- Processes — what operations are performed, by whom, and how.
- Outputs — includes basic statistical data, as to items purchased, catalogued, processed, circulated, etc.

STEP 4 Identify problem areas and/or areas that could benefit from change:

- Areas where there are presently inefficiencies in work flow, service levels, staff utilizations, etc.
- Areas that could benefit from enhanced levels of service although at the present time are operating adequately.
- Areas where rapid growth has been experienced or is projected and where alternative methods of operation should be explored.

Determine if the isolated areas relate to technical aspects of the operation which could be considered for automation. Symptoms in problem areas which could benefit from the application of technology include the following:

- Labour intensive procedures where staff time and dollars expended appear to be excessive.
- Lack of access to information where users or staff simply cannot get to information as required.
- Poor control over information where complete information is not readily available as it is spread over multiple files, catalogues, etc.
- Lack of timeliness where information as available is out of date.
- Lack of accuracy where information as available is incorrect, misleading or conflicting.

Once you have analyzed your needs, you will have to come up with some facts and figures for those functions to be automated, and communicate them to potential vendors. The following section of this booklet outlines what questions you have to ask yourself and the vendor.

2.2 WHAT DOES A VENDOR NEED TO KNOW?

In order for you to be able to discuss your automation requirements with a vendor, it is essential that you determine what is involved in your functions, the volume of records in these functions, and how important these functions are to your operation. Doing your homework now will ensure that you get the best advice later.

It is important that you ask yourself the following questions:

I. What is involved in the function? That is, what kind of information is essential to the function, how frequently is it used, what prerequisites are required, etc.?

II. How many files of information are required by the function? How many new ones are created yearly?

III. Within each file, how many pieces of information are there? For example in a single file, you may have recorded the following:
— name
— address
— subject headings
— cross references
In this case, there are four pieces of information.

IV. What is the length of your longest piece of information in the file? This can be calculated by counting the letters, numbers, spaces and punctuation marks, i.e., JONES, James = 12 characters.

V. Is the information in the file cross-referenced to other files? If so, to what?

VI. What results from the successful completion of the function? For example, the creation of a new file may result in a 3×5 card. In information retrieval, the request may result in the answer being displayed on a computer screen.

VII. Is the function essential to your operation now, or do you consider it to be a desirable option in the future?

Now, in order to effectively discuss your requirements with a vendor, you will have to "translate" the above questions into computer terms.

A sample exercise is located in Section 5.3.

Once you are comfortable with these terms, it is time to start documenting your requirements for a vendor. It is important to put these in writing, as you will then have a record of your communication with the vendor. Section 5.4 illustrates a sample chart for this purpose.

At this point in the process, it is not necessary to concern yourself with **software** or **hardware**. The vendor will be able to advise you as to whether or not software is readily available for your functions, and then will be able to help you regarding hardware. Remember that your local vendor may not be familiar with **functional** packages that are specific to libraries or museums.

3. SELECTING THE VENDOR

3.1 THE MARKETPLACE

The microcomputer industry is young and rapidly growing. More and more software and hardware is becoming available, almost every week. It is, therefore, important to look at the microcomputer market and to carefully analyse the options available.

First of all, be prepared to comparison shop. This, of course, is only feasible if you have more than one microcomputer vendor in your area, but you could "shop by phone" to ensure that you have been informed of the most up-to-date technology on the market. Some local authorities may insist that you contact a specific number of potential vendors, depending on the municipality's purchasing procedures. Check also with other services. What were their experiences?

Microcomputer vendors operate on a narrow profit margin. Accordingly, most vendors are neither willing nor able to spend a lot of time helping you to select a microcomputer. The buyer is expected to do the "walking and talking" necessary for understanding the differences between products.

Another result of small profit margins is that the vendor may offer only the basic equipment and software. You may have to pay extra to have it installed and made operational.

Other matters to be aware of concerning the microcomputer market include understanding that the vendor of generic packages might not have written them — the manufacturer did. The vendor is only the middle man and may be able to provide you with relatively limited information. However, it is your prerogative to ask to see related manuals or to examine the package on a trial basis. Vendors of functional packages for cultural organizations, especially libraries, are relatively common now, with applications ranging from acquisitions and inventory to discharge and overdues. Generic packages such as accounting and word processing are available everywhere.

Don't talk to vendors on a hardware basis. You must first find a software package that will suit your needs. However, keep in mind that if you are planning to add future applications/packages to your system (as yet undefined), the hardware you purchase for your first package must be able to handle the additional packages.

Once you have made contact with vendors, it is wise to continue any future communication with them in writing. If the vendor wishes to continue business with you, he should also respond in writing. Your documented requirements and the vendor's written response will avoid misunderstandings and will be a useful addendum to any contract.

Finally, the focus when selecting a microcomputer should not be on identifying the vendor with the lowest price. Rather, you should concentrate on finding the vendor with the highest quality application software and the best reputation for support.

3.2 DEALING WITH A VENDOR

If you are considering automating a simple office function, you will more than likely be dealing with one vendor for both hardware and software. If you are looking at automating your library functions, you may be dealing with several vendors. As well as providing your technical requirements (as determined by your needs analysis) to the vendors, you will want to ask them additional questions. These questions can be asked prior to the formal submission of your requirements or can be included in your written request for vendor response.

- What kind of support do the vendors offer? That is, will the vendor provide any training for your staff; would you be able to telephone for advice or assistance; would the vendor voluntarily advise you of new technology or applications?
- What kind of **maintenance** is available? The only kind of hardware maintenance available for most microcomputers is remedial maintenance, i.e., when something goes wrong, you can ask the vendor to fix it. For software, maintenance generally takes the form of providing assistance to the user when problems are encountered in running an application program. Some vendors provide this support by telephone. In some cases it is possible to negotiate with the vendor to make modifications to the package as the need arises, for a charge. New releases of software can be provided to licensed users for a fairly nominal charge — generally between 5–20% of the original purchase price. A new release may have enhancements (e.g. a spelling checker may be added to a word processing package) and previous errors should be eliminated.

- What kind of performance does the microcomputer offer? Do not allow yourself to be distracted by hardware performance claims. The most important factor is the speed of the operator in entering data and correcting errors, *not* the speed of the processor.
- What kind of documentation is provided?
- Do I have to worry about **compatibility**? As there are few standards, microcomputer buyers have to be cautious about compatibility (the ability of one part of a computer system to work with another). At present, 80% of all microcomputer systems are either IBM or IBM compatible. If you are buying a mixed system (i.e., different vendors or manufacturers) get expert advice. Experienced buyers insist that the vendor demonstrate the equipment, program, or files working together.
- How reliable is the system? Reliability encompasses the frequency of failure, how quickly service is provided, and the effectiveness of service. Ask the vendor to provide references, if possible.
- Is the system expandable? Microcomputer systems must be able to grow in terms of applications (you may wish to add more applications) and volume (more information may have to be processed in the future). Experienced users choose a system that is able to at least double in both disk size and printer speed.

Once you have collected whatever background information you require, you are ready to ask the vendor to respond to your software and hardware requirements. As noted before, you do not need to define your hardware requirements in detail — they are almost totally dependent on the software package you choose. The vendor should be able to make suitable suggestions regarding hardware once the software has been decided upon.

You will want the vendor to respond with the following information.

Vendor experience — i.e., their qualifications, a description of their customers, etc.

Technical description — i.e., a vendor's proposed system that meets your requirements in terms of hardware, software, and associated technical assistance such as maintenance, installation, and training support.

Costs — i.e., firm costs, valid for a specified period of time, for the purchase, installation and operation of the vendor's system.

In order to facilitate the vendor's response, you could provide him/her with a copy of your needs analysis, timetable deadlines, contract expectations (e.g. penalty clauses for non-performance), and those questions listed above. Once again, it is wise to do this in writing.

3.3 WHAT WILL MY COMPUTER COST?

Costs may be divided into those costs as specified by the vendor and other system related costs; each of these may then be subdivided into one-time costs and ongoing costs. It is unlikely that a microcomputer installation will result in cost savings. However, the initial expenditure and ongoing maintenance costs can be justified in other ways.

Let us look first at vendor specified costs. In response to your request for information, as outlined in section 3.2 of this chapter, the vendor will have provided you with one-time and ongoing costs. These should cover the following areas:

One-Time Costs:
- processing unit
- key board(s)
- disk drives
- CRT
- printer
- accessories (i.e., modem if you are looking at communicating with another installation)
- system software
- application software
- training and education
- conversion costs (if the vendor is going to adapt an existing program)
- technical support, including documentation
- delivery, installation

Ongoing Costs:
- annual maintenance of hardware and software

One-time system related costs, to be determined by yourself, could include:

- site preparation (acquiring extra furniture, adapting your present environment)
- site visits (seeing how other installations work)
- insurance on delivery of equipment (if applicable)
- data base creation and editing
- dealings with a lawyer if you feel a vendor contract warrants it

Ongoing system related costs could include:

- supplies
- communications, i.e., Bell Telephone lines if you will be interacting with another installation

You can total these costs to determine the dollars you will have to spend over a three- to five-year period of time. However, do not look at this cost without considering the benefits, even if they are not dollar quantifiable, of automation.

- Can you eliminate any supplier and service contracts as used in the present system and no longer required in an automated system?
- Will the quality of service to users be improved? That is, would there be an improvement in service if a hard copy catalogue could be produced from an automated data base?
- Would your routines be simplified, and made more efficient and accurate? An automated system may simplify and shorten many of the processes, and may eliminate certain paper files.
- Would management be better served? An automated system can maintain statistical data which can be manipulated for the purpose of producing a variety of statistical and management reports.

Don't forget to investigate your community as to the possibility of obtaining donated equipment or supplies. You should also look into grants and donated monies.

Weigh your benefits against your costs. Is it feasible to continue considering automation? If you are undecided at this point, read section 3.4 Alternatives, of this chapter. It will provide you with suggestions concerning different approaches to an automated environment.

3.4 ALTERNATIVES

So far, you have been primarily concerned with deciding whether or not to purchase a stand-alone microcomputer, i.e., one that is installed on your premises and is unique to your operations. If you feel that there are benefits to automating, but you do not know whether a stand-alone system is justifiable, you could look at:

- Sharing another organization's computer. You could purchase the software and use their hardware, assuming it is compatible. This could reduce your expenditure but may require contracts, delays, and/or new procedures.
- A co-operative venture with other cultural organizations. Your costs would be greatly reduced, and because they are in the same field, you may share most or all of the programs.
- The purchase of computer services through a service bureau.

If it is not at all feasible to automate, you could consider the following:

- Do nothing. It is possible that your best choice is to live with your present situation. The situation could be reviewed in one or two years.
- Streamline your current manual methods. In taking a look at your current systems and procedures, you may have uncovered practices that could be simplified or eliminated. If so, taking these steps may be sufficient.

The work performed in your needs analysis and discussion with the vendors should not be considered wasted — you will have gained exposure to automation and should priorities be re-evaluated, and funding becomes available, you will be in a position to proceed quickly in the future.

3.5 EVALUATING VENDOR RESPONSE

In order to evaluate vendors' products and service fairly, it is necessary to tackle the task in some planned way. Once information is received from a vendor it should be tabulated in chart form or in some other structured manner. The information should be broken into these areas: cost, system capabilities and vendor considerations. In some cases, system capabilities and vendor considerations should be validated against reference checks and site visits.

Before comparing vendors' costs, compare the quality of their products. Develop your own selection/quality criteria according to what is most important to you. Some common considerations are:

- quality of software — what will it do for me?
- vendor reputation and experience
- reliability of hardware and operating system
- implementation/conversion plan
- support

Once you have identified your selection criteria, decide which are most important to you and assign them values. For example, out of a total of 100 points, software capability may be worth 40 points to you, vendor reputation 20 points, etc.

Evaluate the vendors' submissions and assign each vendor a percentage score. For software capability, Vendor A might have met half of your requirements (originally a 40 point value), Vendor B 30%, and Vendor C 70%. These scores cannot be totally objective; you simply have to use your own best judgement and weigh whatever informed advice you can obtain.

In deciding which vendor best meets your quality criteria, use the vendors' written responses and any other material the vendors may have supplied.

Each of the values can now be multiplied by the percentage factor to arrive at a weighted point score for each criteria. For example, Vendor A's point score for software capability is 40 × 50% = 20 points. For each vendor, total the resulting points. A sample exercise can be found in Section 5.6.

Once you have determined how many points to give to each vendor selection criteria, you should assign both one-time and ongoing costs. These total costs can be divided by the number of points awarded to determine the cost per point for each vendor. The vendor with the lowest cost per point is, on the surface, the most qualified vendor. However, you will need to verify the strengths and weaknesses you have identified with both the vendor and his or her customer references.

Go with the vendor who you think has the *best experience, software* and reputation for *support*. Your final commitment will be made during your contract negotiations.

3.6 CONTRACT NEGOTIATION

As the word implies, negotiation of a contract involves give and take on the part of both the organization and the vendor. Basically, you want to purchase a system; the vendor wants to make a profit on services rendered. Since a contract is a legal document, you may wish to obtain the services of a lawyer.

The vendor's standard contract will provide the basis for negotiation. As negotiations proceed, amendments and additions will be made to the contract; system capabilities may change, an implementation plan will be worked out, project schedules will be agreed upon, penalty clauses will be decided, etc.

It is not possible to define all the specific terms which could be included in every contract. However, a basic outline could include the following:

- terms for delivery of hardware and software
- installation
- enhancements/modifications to basic application software
- training and documentation
- software maintenance
- payment terms, including down payment, progress payments and holdbacks
- warranties and penalties regarding non-performance or late delivery

In order to minimize disputes, the following documents should be attached to the contract as appendices:

- your original statement of requirements
- the vendor's written response to your requirements
- the agreed upon schedule for implementation

Ideally, the contract is a document which can be put away, and which hopefully will never be used. However, the relationship may not always stay as friendly as it is at the outset. In this eventuality, it is highly desirable to have a document which details specifically the terms of the agreement.

4. IMPLEMENTATION

4.1 PLANNING

Management of the implementation process is critical, since a number of people and activities must be co-ordinated in order to ensure that the system gets up and running. If a project manager was not previously assigned, one should be appointed at this juncture. The project manager's areas of responsibility at the implementation stage include the following:

- Supervision of the organization's share of the system implementation plan as negotiated in the contract with the selected vendor. This includes determining the required resources in terms of personnel to perform all the necessary tasks, evaluating progress, identifying problems, developing solutions and rescheduling the process in conjunction with the vendor, as necessary.
- Liaison with all vendors, as the official cultural organization contact, during system implementation. Vendors will include not only the selected automation vendor, but also contractors involved in site preparation, database creation, etc. The project manager monitors vendor activity as required under the contract. If any problems arise, the project manager and the vendor(s) together attempt to rectify them.
- Reporting of ongoing progress on system implementation to the organizations' management and other interested parties.
- Preparation of general staff and users for the advent of the automated system.

In order to control implementation, a schedule is required. A sample graphic plan is included.

Note: This schedule assumes the implementation of more than one application.

4.2 SITE PREPARATION

Electricity

A microcomputer will operate on standard 110-volt AC power. It is best to have a separate circuit-breaker and line from the control panel to the electrical outlet you will be using. The circuit-breaker should be labelled, so that someone does not accidentally throw it when you are halfway through a big job. If your electrical power is inclined to surge, you could install power filtration equipment or voltage regulators, available from computer stores. This will prevent processing errors or physical damage that can be caused by surges. Light bulbs may tolerate flickering; computers commit a quick and quiet suicide at the first little burp in power.

Location

The microcomputer does not belong in an inaccessible, dark corner of the office where it is hard to get at and use. Heat will probably build up if it is located in a small, unventilated room. Nor should it be placed in the direct glare of sunlight (it makes a screen hard to read). You may wish to locate it near a telephone so that you don't have to leave the micro in order to take or make telephone calls.

Do not place your microcomputer on a carpet, since the static build-up can cause equipment failures. If this is unavoidable, place the machine and its furnishings on a grounded, anti-static mat. It is also a good idea to keep the microcomputer and your supplies in a reasonably humid environment (this may require a room humidifier in winter). The microcomputer and its surroundings should be kept as dust-free as possible.

Security and Backup

Equipment can be insured; however, data cannot. Special safeguards should be taken to protect vital data which may be impossible or very expensive to re-create. Duplicate copies of vital data should be stored away from the computer site, preferably in a fire-proof vault. A regular program for updating the duplicate data is necessary to maintain the value of back-up storage.

Software should have security built into it. Data should be protected from unauthorized access. Staff should have access to only those computer functions and discs with which they are required to deal in their working day.

When entering data, it is advisable to transfer the data to discs at regular intervals. Both the data, and the effort it took to enter it, can be too readily lost without this precaution.

Installation

Depending on what you have arranged, the vendor may deliver and hook up the microcomputer and its peripherals. If this has not been arranged, the operating manual should explain how to connect the pieces of equipment. Read the instructions before turning the machine on for the first time.

4. IMPLEMENTATION

With larger types of computers, file conversion and training commonly begin before the computer is installed. Not so with microcomputers. It is usually more convenient and less costly to install the computer in your office before doing any application training and file conversion.

4.3 PROCEDURES

It is important that procedures to support your microcomputer be developed and documented. Step-by-step descriptions must be written down and kept up to date. This function can be performed prior to and during implementation.

Documented subjects should include:

- how to run the application
- how to prepare and correct input
- how to use output
- how to obtain service and supplies for your microcomputer

Good documentation makes it easy to carry out procedures consistently and ensures continuity.

Involve your staff in the development and testing of the procedures. After all, they are the ones responsible for following these instructions.

4.4 DATA CONVERSION

A major issue for an organization considering automation is how to get files into machine-readable form. Active or "live" records are usually entered directly into the computer after it has been installed and when the system is up and running.

There are a number of strategies which you may consider for a large collection (e.g. catalogue or inventory files). Two of these strategies are noted as follows:

- Load machine-readable records from an outside source to a computer after installation. This may require vendor support if the files have to be converted into a language suitable for your computer.

  Your staff could accept, reject or modify the data as received.

- Build a data base at a computer service bureau in advance of installing a computer. The advantage of this method is the ability to produce a microform catalogue without owning a computer. A possible disadvantage is the ongoing service bureau costs of maintaining this data base if it is not loaded within a reasonably short length of time into your own computer system.

Small record collections (e.g. budget or personnel files) may be keyed directly into a computer after installation. This presumes that the files are of sufficient quality to build a data base.

4.5 PARALLEL RUN

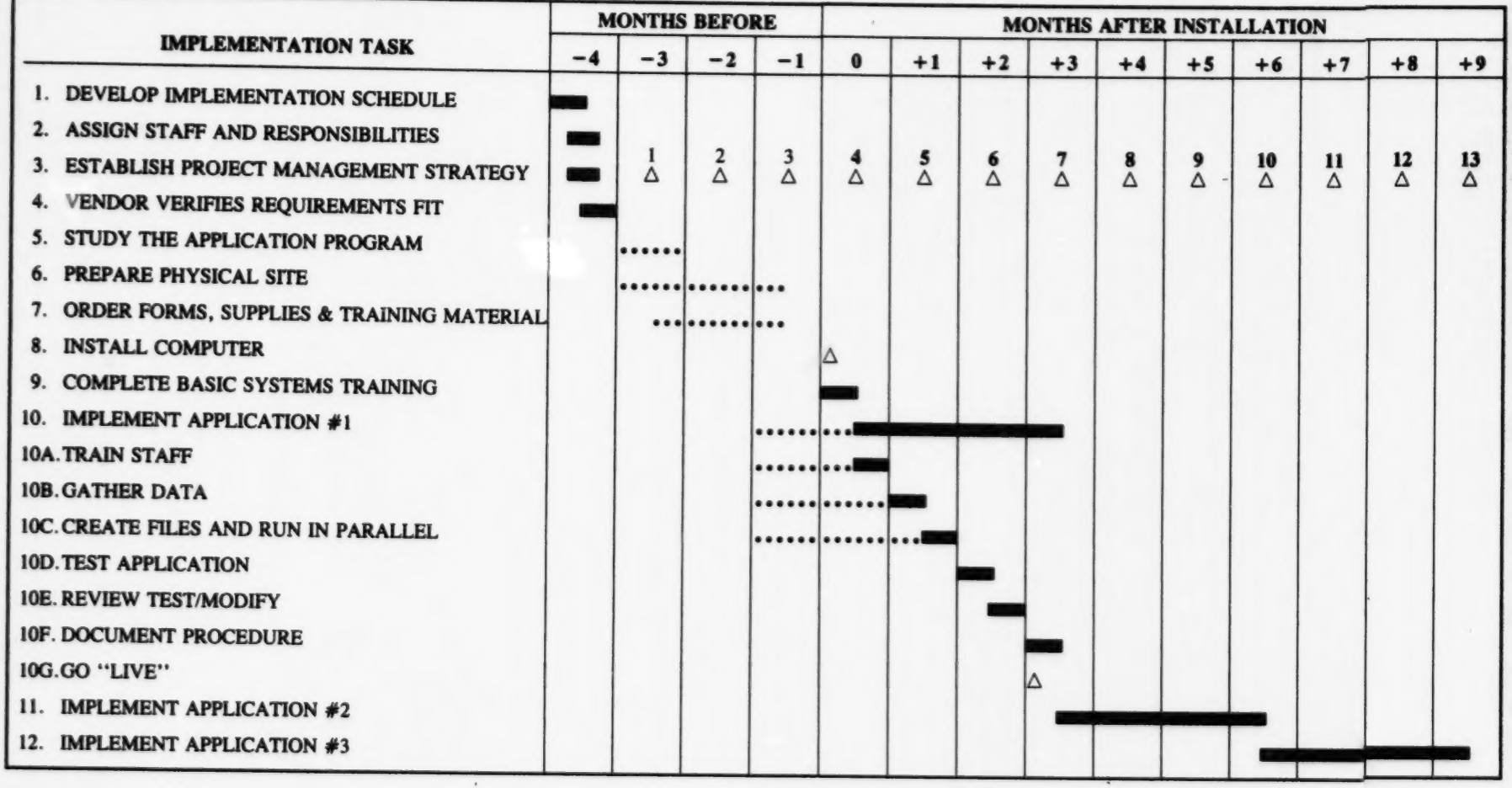
With the application program and data loaded into the computer, you are ready to start running the computer system "in parallel" with your existing system – that is, the two systems run side by side until you are satisfied that the new system is performing as it should.

There are two useful alternatives to parallel running with *current* operations. One of these is to enter detailed transactions for some *past* period or part of a past period, run the program using these data and then check the results against those obtained for that period using the old system. The main advantages of this procedure are: 1) you can do the run outside peak workloads, 2) you are parallelling work known to be accurate, and 3) you are creating historical files that you may require in any event. This approach is called a historical parallel run.

Another method is to select only part of a file for parallel running under either method described above. While not as comprehensive as the other two methods, this partial running has the advantage of requiring less staff time than the other methods.

4. IMPLEMENTATION

IMPLEMENTATION SCHEDULE



Continuous Task

Intermittent Task

△ Review

4.6 SYSTEMS ACCEPTANCE TESTING

Before cutting over from parallel operation to using only the computer, carry out some tests. You want to establish that certain errors *do not* occur, for example:

- Use of invalid codes
- Alphabetic characters entered in numeric fields and vice versa (e.g. trying to enter the word "January" instead of the numbers "01" for the month)
- Values beyond the specified range
- Erroneous conditions (e.g. creating two cheques with the same number)

When you deliberately enter invalid data, the computer should respond by rejecting the data or by displaying an error message on the screen. Ensure that the operator fully understands what each message means and how to handle it.

Mistakes such as entering valid but incorrect data (e.g. a mis-typed code) will occur. Find out how to correct such mistakes, and what safeguards are in place to prevent them happening.

The vendor can help you to develop a series of tests to check for the conditions described above.

4.7 STAFF TRAINING

Orientation and training in the use of the automated system is an essential part of the implementation process. During contract negotiation, the organization and the selected vendor will have reached agreement as to the specifics of training to be provided by the vendor.

Most vendors will provide several levels of training. General overview sessions may be provided for management, as well as for general staff. Specific training sessions will be held, either on-site or off-site, for key personnel who are going to operate the system, as, for example, the people who will be responsible for the day-to-day operation of the computer. A common vendor strategy is to train several people, who in turn are responsible for training the rest of the staff. Training will occur throughout the implementation process from the time the equipment first arrives until the system is fully operational throughout the centre. You can assume that it will take 40 hours for a staff member to become proficient in the operation of a generic package (e.g. word processing). It is important that staff be scheduled in such a manner that practical use follows the training sessions, in order to provide reinforcement of what was learned.

Vendors provide a number of guides for use in training and operation of the system. These may include a computer operator's guide, a terminal operator's guide for various functions, etc. Your organization may also prepare specific instructions for staff to refer to on a daily basis pertinent to specific use of the system — they can be as simple as a single page memorandum.

4.8 ERGONOMICS

Ergonomics is the study of the relationship between human beings and machines and the effects of this relationship on human performance. The relationship is both psychological and physical. For example, many people's attitude towards technological change is either indifferent or negative. They consider automation a gimmick and are convinced that their performance is already optimal. On the other hand, some employees are overly enthusiastic about technological change, and can easily dominate more timid staff members.

From a physical point of view, the installation of a microcomputer should not hinder staff performance. Is the furniture associated with the computer comfortable? Is good lighting provided? Is there room around the computer to easily display input and output documents? Can staff be distracted by patrons due to the placement of the equipment?

These matters definitely have to be considered and addressed. Usually, by providing all staff with an opportunity to learn about the new microcomputer system, most staff members will eventually view it as a positive and practical contribution.

4.9 PUBLIC RELATIONS

Public relations is an important part of implementing an automated system if the system affects the patrons. It is necessary that the organization's users be informed as to what the automated system is, what it will do and how it will affect them: the usual public relations tools can be used in this process including signs, newsletters, etc.

4.10 POST-IMPLEMENTATION REVIEW

The final stage in the development and implementation of a computer system is often forgotten or ignored. The post-implementation review is, however, an important step and could well make the difference between a successful or less than successful implementation.

The review should cover the following topics:

- Determination as to whether the objectives and benefits have been achieved.
- Evaluation of the accuracy of system cost estimates and project timetables.
- Evaluation of the operational performance of the system. Is it doing the right things at the expected cost as outlined in the user requirements and in the contract?
- Evaluation of documentation. This includes documentation required by staff to interact with the system and, if the system has been purchased, the arrangements to acquire the rights to the programming documentation in the event that third party maintenance be required if in future the vendor cannot support the system. The need for good documentation cannot be overemphasized.
- Identification of problem areas and recommendations for correction. Problem areas may include organizational or procedural practices which need fine tuning, or corrections to the computer software may be required.

5. LIBRARY APPLICATIONS AND WORKSHEETS

5.1 INTRODUCTION

There is a great deal of interest in and confusion about the use of microcomputer technology for library applications. Is it possible to automate circulation on a microcomputer? If the library is small, can a microcomputer function as an online catalogue? How big a microcomputer system do you need to perform these functions? Is it possible to use a microcomputer to produce catalogue cards? How can a microcomputer assist in the processing of books? What about data base searching on a microcomputer?

These types of questions are being repeated with greater frequency by a growing number of librarians. Unlike many of the other library-oriented technologies, the relatively low cost of microcomputers has placed them within the reach of virtually every library, from large academic research libraries to small public school learning resource centres. Unfortunately, the skill development and training of library managers and information professionals in how to properly evaluate and apply this new resource have not matched the fast pace of technological innovation. Librarians are still struggling, attempting to cope with how to best use microcomputer technology to meet the specific functional needs and requirements of the library. For purposes of discussion, library applications on microcomputers can be divided into two categories.

Library Applications:

Generic

- Word processing
- Accounting
- Numeric spreadsheets
- Communications

Functional

- Serials control
- Circulation control
- Acquisitions control
- Genealogy
- Community information systems
- Online public access catalogue
- Cataloguing
- Technical service functions
  - Card catalogue card production
  - Spine labels
  - Book pockets
- Data base searching
- Film/media booking
- Computer aided instruction
- Mailing lists
- Reference guide/Index production.

It is not the purpose of these general classifications to encourage libraries to invest in some applications while abandoning others. It is probable that many libraries have invested in the generic applications, such as word processing, and have realized little or no success in making a significant contribution to library service. There are no magical formulas, no certain cures. What is most important for the library manager to consider when examining any potential library applications on microcomputer technology is the technical feasibility of the desired application(s). The library should also establish specific goals, prepare a realistic timetable, and develop a plan for staff to follow in implementing the project.

At the present time, it is more practical to look at applications that have been purchased by a number of users and which have been proved to be successful. Generally speaking, these include most generic applications (i.e. financial and personnel systems, word processing, etc.). There are also some functional library application systems which are micro-based such as the management of statistics, acquisitions and on-line reference. Circulation and on-line catalogue microcomputer systems do exist, but most have been designed for small library collections (less than 25,000 titles). However, it is encouraging to note that newer and larger microcomputer systems are being developed.

The first step in automating any library process is to perform a general study of whether the proposed project is practically and technically feasible. This feasibility analysis examines the resource and constraints of two different environments — internal and external. First, it is necessary to examine the internal library

environment to determine if sufficient hardware and human resources are available to successfully carry the activity to fruition. Secondly, it is necessary to determine if service providers and vendors (the external environment) exist who can provide products and resources necessary to meet the specific needs of the library.

The following activities should be undertaken when determining the feasibility of automation.

First, identify your functions and isolate those that could benefit from automation. Become familiar with computer jargon so that you can speak knowledgeably about files and records. Determine what potential vendors need to know about your requirements; then evaluate their responses. Sections 5.2 through 5.8 provide some practical exercises to help in determining your automation requirements; section 5.9 lists further reading or contact groups.

5.2 FUNCTIONS (see Section 2.1)

One of the first steps in determining whether or not your library could benefit from automation, is to identify your functions. The functional components of a smaller library are as follows:

- administration
- circulation
- acquisitions
- cataloguing
- reference

Each of these component parts can be broken down into functions. The following listing is not intended to be a comprehensive reflection of a library's operations. It is to be used as a guide in determining your own specific functions.

ADMINISTRATION
- budget and financial reports
- grant applications
- bookkeeping
- payroll accounting
- mailing lists and labels
- orders and invoices for supplies and furniture
- inventory of supplies and furniture
- forms
- mail

CIRCULATION
- charge
- discharge
- renewals
- update
- reports and statistics
- overdue accounting and notices
- reserves
- user registration

ACQUISITIONS
- selection
- ordering
- receiving
- supplier information
- statistics
- accounting

CATALOGUING
- record creation
- production and maintenance of the catalogue
- spine labels
- authority control
- multiple copies
- staff access

REFERENCE
- information retrieval
- interlibrary loans
- public access
- statistics
- bibliography creation
- indexes of local information

5.3 TRANSLATING DATA INTO COMPUTER TERMS (See Section 2.2)

Should the library wish to talk with a vendor concerning the automation of their information retrieval functions, the following terms would be used:

Data Base = card catalogue or circulation file (i.e. a collection of cards stored in such a way that information can be accessed, retrieved or rearranged easily).

5. LIBRARY APPLICATIONS AND WORKSHEETS

File = subject/title/author cards or patron files (each file contains related records, e.g., your subject file contains records related to subjects; your patron file contains records related to various patrons).

Record = single card (a record contains related pieces of information, e.g., title, author, etc.)

Field = entry on a single card (a piece of information in a record or card). Each field contains a group of logically related characters or numbers, letters, punctuation marks and spaces. For example, an author field may contain DOE, John A. The field length is 12 characters/spaces/punctuation marks.

Now, look back at the questions posed in Section 2.2 and apply computer terms to them. For example, question II is referring to records — the total number of cards in your title, subject, or author file. Questions III and IV refer to fields; question VI to output.

Similar analogies can be drawn between lateral file cabinets and a computer, or a Rolodex system and a computer.

5.5 HARDWARE/SOFTWARE VENDOR CHECKLIST

The following questions will be helpful during any of several stages of the automation process:

- when defining your needs
- when drawing up a list of experienced vendors
- when visiting the vendor's premises or customer sites
- when confirming your final selection.

A. Does the package fit?

1. Does it meet my essential requirements?
2. Can it be modified, either by the vendor or by myself?
3. Is it part of a set of systems?
4. Can I test it prior to purchase?
5. What types of edits and controls does it contain?

5.4 VENDOR'S REQUIREMENTS LIST (see Section 2.2)

		INPUT		OUTPUT	
FUNCTION	DESCRIPTION	# OF RECORDS	# OF FIELDS PER RECORD	HARD COPY	ON-LINE
CIRCULATION					
1. Create/update title files	Contain author, title data, imprint, call number data	30,000	8	N/A	full title record
2. Create/update patron files	Contain patron name, number, address data	7,000	5	N/A	full patron record
3. Checkouts	Capture title/patron data, due date	75,000	4	statistics	title record and circulation status
4. Returns	Capture title/patron data	75,000	4	N/A	N/A
5. Reserves	Capture/hold data and produce notices	3,000	4	post card	flags title with patron name
6. Overdues	Capture overdue data and produce notices	1,000	4	post card statistics	updated patron file

Note I: The vendor should be notified that field lengths vary greatly, e.g. a corporate author vs. an individual author.
Note II: Annual growth rate of title file = 5%.

B. How easy is the system to use?

1. Is sign-on easy?
2. Are there sufficient clear commands, warnings, and instructions?
3. Is the screen layout straightforward?
4. What reports can be produced?
5. In processing failures, is data saved?

C. How well will the system perform?

1. Is it easy to install (i.e. do existing procedures need to be changed; how much data will have to be entered; will the package be available when I need it)?
2. What is the response time?
3. Can it be easily changed in the future?
4. Will it allow expansion in terms of record lengths and file capacities?
5. Has it been thoroughly tested?
6. Does the vendor offer any warranty on reliability or performance?
7. Does the vendor provide references?
8. Can the hardware be expanded?
9. Is it running successfully in a library of a similar size?

D. Compatibility?

1. Does the chosen software run on the computer?
2. Is the micro compatible with larger computers?
3. Can hardware made by another manufacturer be attached to this computer?

E. Documentation

1. Are the manuals clear and concise (both user and operating manuals)?
2. Are there diagrams?
3. Is error correction clearly explained?
4. Are the manuals updated?
5. Is a technical manual provided (codes, flow charts, details of file layouts, file cross-references, etc.)?

F. Training

1. Is training available? on-site? classroom? self-study?
2. Is additional training available?
3. Can training be conducted after hours?
4. What costs are involved?

G. Service/Maintenance/Support

1. Is there a warranty period?
2. Does the vendor provide service/maintenance?
3. Is service available locally?
4. Will service be provided within a guaranteed time frame?
5. Is maintenance provided on-site?
6. Is consultation service available? telephone? locally?
7. Will the vendor modify the system if my needs change?
8. Does the vendor provide planning, conversion, implementation assistance?
9. What enhancements (i.e. new software) are planned?
10. Will the vendor notify me of enhancements?
11. Is there a cost for enhancements?

5.6 EVALUATING VENDOR RESPONSE (see Section 3.5)

VENDOR EVALUATION WORKSHEET

Vendor ABC Company

Selection Criteria	Values	Success %	Weighted Points
Quality of Software	40	50	20.0
Vendor Reputation	10	75	7.5
Hardware Reliability	15	60	9.0
Implementation Plan	10	100	10.0
Support	25	50	12.5
	100		59.0

One Time Costs =	$20,000.00
Ongoing Costs = (5 years)	$ 5,000.00
Total Cost	$25,000.00
Cost per point =	$ 423.73

Note: For a breakdown of one-time and ongoing costs, see Section 3.3.

To complete the Vendor Summary, rank each vendor relative to one another on a point basis, and a dollar-per-point basis. That is, look at Column A and rank the vendor with the highest points as 1, the vendor with the second highest points as 2, and so on. Record these rankings in Column D. Then look at

5. LIBRARY APPLICATIONS AND WORKSHEETS

VENDOR SUMMARY (see Section 3.5)

VENDORS		A	B	C	RANKING D	E
SOFTWARE	HARDWARE	TOTAL WEIGHTED POINTS	TOTAL COST	$ PER POINT	HIGHEST POINTS	LOWEST $/POINT
ABC Company	ABC Company	59	$25,000	$423.73	2	2
DEF Company	GHI Company	65	$30,000	$461.54	1	3
JKL Company	MNO Company	43	$17,000	$395.35	3	1

Column C and rank the vendor with the lowest dollar-for-point score as 1, the next lowest as 2, and so on. Record these rankings in Column E.

The highest total point score indicates the best vendor regardless of cost. The lowest dollar-per-point score suggests the vendor who represents the best value (i.e. taking both cost and quality into account).

However, this ranking is based only on information supplied by the vendor. You will need to verify these results with both the vendor and customer references.

5.7 APPROVALS

Below are some topics that could be covered in a report to your Library Board, if you need to obtain their approval prior to the selection of a microcomputer vendor. Should it be necessary, this type of report could be submitted to the Board at the end of the preliminary planning stage of your project.

1. Strengths and weaknesses of the current system
2. Objectives of the new system:
   - possible applications
   - priorities
   - improvements sought
3. Practicality considerations:
   - operational
   - technical
   - economic (costs and benefits)
4. Conclusions and recommendations:
   - recommended software and vendor
   - recommended hardware configuration and vendor
5. Appendices:
   - work program for future phases (implementation)
   - computer committee: composition and responsibilities; or names of advisors
   - vendor evaluation summary
   - alternatives considered

5.8 LIBRARY SOFTWARE

The following library software is distributed and supported in Canada. Address information is provided in Section 5.9.

Circulation Plus: This is a menu-driven circulation system capable of managing 25,000 books and 8,000 patrons on a 5 megabyte hard disc drive. Check-in and check-out are supported by barcode technology, and daily notices and long-term reports can be produced. Overdues and reserves are accommodated. A *Circulation Plus* demo disc can be ordered and used to test all activities associated with 250 books and 150 patrons. This package is available from Bibliofiches.

Infoquest: Utlas International Canada provides this package. It is designed for collections of up to 25,000 bibliographic records. The Online Public Access Catalogue (OPAC) module provides a broad range of retrieval functions, including see and see also references, multilevel displays, generation of statistics on catalogue use and local message edit control. The *Infoquest* circulation module can be purchased with the OPAC module or added later. It is fully integrated with the OPAC data base, uses barcode technology, and generates overdues, recalls and "hold available" notices.

Inmagic: This is a file management/text retrieval system which was originally developed in 1980 for minicomputers. It has been available for use on microcomputers running MS-DOS for several years. *Inmagic* can be used for a variety of library applications, (in-house data bases, indexing, cataloguing, acquisitions, serial and circulation control) as well as non-library applications. The broad range of applications is due to the flexibility of defining data structures, a powerful report generator and a range of indexing and searching options including Boolean operators.

Mandarin: This is a database management system for circulation control, online catalogue and cataloguing. Titles can be searched by Keywords and Boolean operators. The circulation system is based on barcode technology. The system can generate statistical reports, overdue and fine notices, and barcode labels. Compact disc technology can be used to create a local data base. This package is available from Bibliofiches.

Ocelot Library System: This is a full service library automation package designed to support libraries with up to 65,000 titles on an IBM PC or compatible. The system consists of three modules, Catalogue, Circulation, and Purchase. It is available from ABALL Software Inc. Bibliofile, a database machine which uses compact laser disc technology to make available the Library of Congress MARC record, is available from the Library Corporation to create a local data base.

Star: This is an integrated hardware and software system which runs on Alphamicro hardware. Software includes circulation, cataloguing, online catalogue and patron maintenance functions. Titles can be retrieved using Boolean operators, parentheses, truncation, etc. The system can produce statistical reports and notices as defined by the library. It can also handle multiple branches with flexibility as to open/close days, fines, etc. It is available from Olivetti Canada Ltd.

Sydney's Micro Library System: Sydney Development Corporation provides this full-function, integrated modular system. Once the base/cataloguing module has been installed, the other modules can be added to it. The system is designed for the small library. The cataloguing system can produce holdings, thesaurus, catalogues and labels. The inquiry system allows searching by any element of the bibliographic records as well as Boolean searching. The acquisitions system allows you to do a pre-order search, order, and receive. The circulation system can perform check-ins, check-outs, reserves, notifications, and operates on barcode technology.

5.9 FURTHER READING/ ASSISTANCE

There are a number of computer magazines available that deal with micro computer concepts and applications. A few are:

Access: Microcomputers in Libraries. 3762½ Herbert, San Diego, California 92103

Advanced Technology/Libraries. Knowledge Industry Publications Inc., 701 Westchester Ave., White Plains, New York 10604

Computing Canada. Plesman Publications Ltd., Suite 302, 211 Consumers Rd., Willowdale, Ontario M2J 4G8

Computerdata. Whitsed Publishing Ltd., 55 Bloor St. W., Suite 1201, Toronto, Ontario M4W 3M1

Hitech News. Perian Press, P.O. Box 1808, Ann Arbor, Michigan 48106

Info Age. 211 Consumers Road, Willowdale, Ontario M2J 4G8

Information Technology and Libraries. American Library Association, 50 East Huron St., Chicago, IL 60611

Library Hitech. Perian Press, P.O. Box 1808, Ann Arbor, Michigan 48106

Library Software Review. Meckler Publishing, 11 Ferry Lane W., Westport, CT 06880

Library Technology Reports. American Library Association, 50 East Huron St., Chicago, IL 60611

Micro Software Review. Nolan Information Management Services, 21203-A Hawthorne Blvd., Suite 5323, Torrance, California 90509

PC World Canada. Rattray Publishing Ltd., 101 Queensway W., Suite 140, Mississauga, Ontario L5B 2P7

Small Computers in Libraries. Meckler Publishing, 11 Ferry Lane West,. Westport, CT 06880

Wired Librarian's Newsletter. C/O Micro Computer Libraries, 145 Marcia Drive, Freeport IL 61032. Att'n: Eric S. Anderson

A few books written on microcomputers in libraries are:

Costa, B., Costa, M. *A Micro Handbook for Small Libraries and Media Centres*. Littleton Co. Libraries Unlimited. 1983.

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James E. Rush Associates. *Microcomputers for Libraries: Product Review and Procurement Guide*. Powell, Ohio: James E. Rush Associates. 1984.

Milliot, J. (Compiler). *Micros at Work: Case Studies of Microcomputers in Libraries*. White Plains, New York. Knowledge Industry Publications. 1984.

Government Publications

The Municipal Management Policy Branch of the Ministry of Municipal Affairs and Housing provides consulting and seminar services to municipalities and has published the following:

Microcomputers in Small Municipalities: A Guide

Microcomputers in Small Municipalities: A Workbook

Microcomputers in Small Municipalities: A Catalogue

Using Computers: A Guide for Municipalities in Ontario

Directory of Computers and Applications in Ontario Municipalities

The Ministry of Industry and Trade has published:

Computer Systems Sources: An Ontario Guide to Canadian Producers of Computers, Word Processors and Components, Software and Services

The Libraries and Community Information Branch of the Ministry of Citizenship and Culture has published:

YES OR NO — What You Need To Know About Automation: A Decision System For Ontario Libraries

The above publications are available from:

- Ontario Government Bookstore
  880 Bay Street
  Toronto, Ontario
  M7A 1N8
  (416) 965-2054

Further Assistance

The Technical Development Unit of the Libraries and Community Information Branch provides consulting services, documentation related to automation, seminars, and clearinghouse activities for automation information. For more information, contact:

- Technical Development Unit
  Libraries and Community Information Branch
  Ministry of Citizenship and Culture
  77 Bloor St. West, 5th Floor
  Toronto, Ontario
  M7A 2R9
  (416) 965-2696

Other sources of information:

- Microcomputers in Libraries Ottawa Users Group
  68 Carmichael Court
  Kanata, Ontario
  K2K 1K2

  Attn: Linda St. Iborn
- Ontario Library Association Micro Guild
  73 Richmond St. West
  Toronto, Ontario
  (416) 363-3388

Vendors

The vendors mentioned in this publication may be contacted at the following addresses:

- ABALL Software Inc.
  2268 Osler Street
  Regina, Saskatchewan
- Bibliofiches
  1557, Rue Begin
  St. Laurent, Quebec
  H4R 1W9
  (514) 336-4340
- Olivetti Canada Ltd.
  Mini Computer Division
  3190 Steeles Avenue East
  Markham, Ontario
  L3R 1G9
  (416) 477-8250
- Sydney Development Corporation
  600 - 1385 West 8th Avenue
  Vancouver, B.C.
  V6H 3V9
  (604) 734-8822
- The Library Corporation
  P.O. Box 40035
  Washington, D.C.
  U.S.A. 20016
- Utlas International Canada
  80 Bloor St. West, 2nd Floor
  Toronto, Ontario
  M5S 2V1
  (416) 923-0890

APPENDIX

GLOSSARY

ACCESSORY see Peripheral.

ADDRESS The means of identification by which the CPU 'recognises' a location in the computer's memory. The address is usually a number. Also used as a verb, e.g., the CPU addresses the memory, meaning that the CPU indicates a specific location.

APPLICATION An activity or task that can be carried out by a computer (the computer can be *applied* to the activity or task). Often used as a synonym for the term 'program'.

APPLICATION PROGRAM A computer program that applies the computer to the user's needs by carrying out a task that the user wants performed, e.g., word processing programs, billing and receivables programs, etc.

APPLICATION WORKLOAD The overall amount of work the computer is expected to perform, considering all the applications that the user plans to run on the computer.

APPLICATIONS SOFTWARE The collective name for the class of computer programs that are designed to carry out specific tasks, e.g., processing the payroll, accounts receivable.

ASSEMBLER A special programming language that converts instructions written in an English-like form into machine-language instructions.

AUDIT TRAIL Records created during the processing of information so that items can be traced to their source, and the processing steps can be verified.

BACKUP Equipment, files and procedures that are available if the original units are destroyed. May also refer to an operator who takes over when the regular operator is not available. Used as a verb to mean the process of making a duplicate copy of stored data or programs as a safety precaution.

BASE PACKAGE see Package.

BASIC (BEGINNER'S ALL-PURPOSE SYMBOLIC INSTRUCTION CODE) A fairly straightforward programming language, used frequently by programmers to write microcomputer and minicomputer application programs.

BATCH PROCESSING Input items, e.g., invoices, are accumulated over a period of time and are then processed as a batch during one machine run. Unlike interactive processing, the operator usually does not communicate with the program during batch processing.

BIT Abbreviation of *bi*nary dig*it*, the smallest unit of information that a computer can read and understand, represented in binary form as a 1 or 0. It takes 7 bits to represent a decimal digit or an alphabetic character. An eighth bit, called a parity bit, is usually added.

BOOLEAN OPERATORS The logical operators AND, OR, and NOT used to show relationships between sets or terms. OR is used to combine terms to broaden a search and increase the search results; AND is used to narrow a search and includes only those terms common to each set; NOT is used to exclude terms.

BUG An error in the logic of a program or a malfunction in the hardware. See also Debug.

BYTE A group of (usually) eight bits of data which the computer handles as a unit. A byte is used to represent one character, and is, for most purposes, the smallest unit on which the computer operates.

CAPABILITY The state of being capable of doing something. With regard to computers, capability refers to all the things that the computer is capable of doing as a result of its degree of technical sophisticatedness, e.g., sharing files among two or more users concurrently or handling two terminals. Capability thus refers to the range of technical functions the computer is capable of carrying out. Sometimes called "richness of function".

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CAPACITY Denotes the amount a computer can handle. With regard to memory, capacity means the amount of data or the size of the program that the internal memory can store at any one time. With regard to the printer, capacity means the number of characters or lines a printer can produce in a given time. Thus, capacity, in contrast to capability, usually refers to some aspect of the computer's performance that can be *measured*.

CENTRAL PROCESSING UNIT (CPU) The processor that performs arithmetic, logic and control operations. It also includes an instruction decoder, program counter, clock, and other elements.

CHARACTER A single letter, number or symbol. May also be called a byte, since one character is represented by one byte or eight bits in most computers.

CIRCUIT Any path along which electricity can flow. In a computer, a circuit is an electronic device that performs a predetermined function.

COBOL (COMMON BUSINESS ORIENTED LANGUAGE) An acronym for a programming language widely used for business applications. Instructions in COBOL are much like English and therefore readily understandable.

CODE Symbolic representation; often used as a "shorthand" way of referring to computer program instructions, e.g., "That programmer writes good code (i.e., programs)."

COMMAND An instruction to the computer, e.g., GO TO. Some keyboards have command keys for frequently used instructions, e.g., print. A command may call a few lines of program instructions, an entire program, or a group of programs.

COMPATIBILITY The ability of two or more things to be used together. Compatibility exists between two computers if programs and data can be run on both without any changes having to be made. Also used to refer to the ability of various hardware components (e.g., input/output devices and the computer) to be used together.

COMPUTER Refers to a general-purpose device that can process large volumes of data electronically, has a central processing unit and input/output devices, and is controlled by a series of predetermined instructions called a program.

CONFIGURATION Several pieces of equipment make up a working computer installation — the central processing unit (CPU), input/output (I/O) devices such as disk drives, storage and so on. The particular combination of pieces of equipment in a given installation is known as its configuration.

CONSOLE The computer component from which the operator controls the actions of the computer, normally consisting of a keyboard and a CRT.

CONVERT To change from one form or state to another. For example, the manual procedures for carrying out a function may be converted to computerized procedures. The entire process of changing the procedures is referred to as conversion. An organization may also convert its computer installation, meaning that a major change is made, moving from, say, a microcomputer to a minicomputer or from using a service bureau to an in-house microcomputer. See also Parallel Conversion.

CPS (CHARACTERS PER SECOND) The rate at which slower-speed printers produce output. They print only one character at a time. Compare with LPM (120-150 cps is equal to 50-60 lines/minute or a full page of computer printout).

CPU See Central Processing Unit.

CRASH Slang for a computer breakdown. See also Head Crash.

CRT (CATHODE RAY TUBE) A video display device resembling a television screen, on which information is displayed. It is linked to the keyboard and to the central processing unit. CRT is often used as a synonym for 'terminal', thus referring not only to the display device but also to the keyboard. Video display terminal (VDT) and video display unit (VDU), and monitor are synonyms for CRT.

CURSOR A pointer or marker on a CRT that indicates the position on the screen where the next input character will be displayed.

CUSTOM PROGRAM A non-standard or custom program is one specially written to meet the particular needs of one user.

DATA Any information that the computer receives as input, processes in some way or stores, and outputs via a screen or printer. Data may consist of letters, words, numbers, or symbols.

DATA BANK A large collection of computer-based records or files, accessible to the public for a fee, containing, for example, stock prices, or legal precedents, or statistical data about the economy.

DATA BASE A collection of files stored in the computer in such a way that information can easily be accessed, retrieved or rearranged. A data base contains information on a particular topic or topics. An *integrated* data base seeks to store each piece of information only once, regardless of where it comes from or how it is to be used.

The hierarchy for organizing information in a data base is as follows: the data base consists of files; each file contains related records; each record is divided into fields or data elements; each field contains a group of logically related characters or bytes, e.g., a referral name. See File; Record; Field.

DATA BASE MANAGEMENT SYSTEM (DBMS) A comprehensive and generally very complex program for accessing, reading, controlling and maintaining large, integrated data bases.

DATA BASE PACKAGE A packaged program that allows the computer user to store information, arrange it in a chosen order, search it, update it, display it and print it out. (Such packages should not be confused with Data Base Management System.) Simpler versions of data base packages are sometimes called file managers. They usually manage only one file at a time. Inquiry packages are another type of data base package, enabling the user simply to request information from the computer. Templates are available for some data base packages. See Template.

DATA COMMUNICATION The transmission of coded data by electrical signals over any one of a variety of media, e.g., telephone line, co-axial cable, microwave, satellite.

DATA ELEMENT See Field.

DATA ENTRY The activity of putting data into the computer by means of an input device (usually a keyboard).

DATA PROCESSING See Electronic Data Processing.

DBMS See Data Base Management System.

DEBUG The activity of solving problems caused by errors or omissions in a program or malfunctions in the computer hardware. (See also Bug.)

DECISION SUPPORT SYSTEM A series of application programs that are used to analyse alternatives to help an individual make a decision, e.g., spreadsheet and modelling packages.

DEGRADATION The slowdown in the computer's response time because the computer has been overloaded by the operator trying to do too much work concurrently.

DESKTOP COMPUTER A computer used for office purposes with all hardware components normally being located on top of a desk. "Desktop" distinguishes these microcomputers from "portable" microcomputers that can be used anywhere and normally weigh under 30 pounds (excluding a printer). Desktop computers can be moved but are *not* readily portable.

DEVICE A piece of computer equipment (e.g., disk, printer, modem).

DIRECT ACCESS see Random Access.

DISK (OR DISC) A means of storing data magnetically on a device that looks much like a gramophone record. The data on the disk can be retrieved randomly. See Diskette; Hard Disk; Random Access.

DISK DRIVE A device which holds the disk and rotates it. (Diskettes have to be inserted into it.) The disk drive is linked to the computer, enabling information on the disk to be transferred to the computer and information from the computer to be recorded on the disk.

DISK OPERATING SYSTEM see DOS

DISKETTE, OR FLOPPY DISK A small, flexible disk that stores information or data magnetically. Floppy disks vary in size: 3" to 3.9" (micro-floppy), 5 ¼" (mini-floppy) and 8" (floppy). Capacity varies from 100KB to 1,200KB.

DISPLAY DEVICE (OR UNIT OR SCREEN) Synonyms for the CRT.

DISTRIBUTED DATA PROCESSING The use by an organization of more than one computer in more than one location to carry out the organization's data processing. Thus, the data may also be stored in more than one place. The computers are linked by communications lines. This decentralized approach can be contrasted with the use of a single computer in a single location, or centralized processing.

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DOCUMENTATION A collective name for all the documents (written records) that give information about something, e.g., the operation of a computer, or all the instructions that together make up a program. To document means to record something in writing. A computer's documentation usually means all the literature provided with the equipment to assist the purchaser in using it.

DOS (DISK OPERATING SYSTEM) A program that controls the computer and enables the application programs to interact with the hardware devices (particularly the disk) so that data can be moved, stored and processed. Used in computers that employ disks as the mass storage medium. Some computers have a built-in DOS; others require a DOS to be loaded into the computer memory from disk before application programs are loaded.

DOT-MATRIX PRINTER An inexpensive printer that creates characters by combining dots.

DOWNTIME The period during which a computer is not functioning, usually because of a hardware or software problem.

DSS See Decision Support System.

DUMP To transfer the contents of the computer's main memory to a peripheral device (the printer or the disk or the CRT).

EDIT To look for errors, which the user then corrects. The data are then ready for further processing.

EIGHT BIT See Word.

ELECTRONIC DATA PROCESSING The electronic processing of data by a computer, including input, calculations, storage and output. (Data can, of course, be "processed" in many other ways — the human brain processes data continuously.)

ELECTRONIC MAIL A means of sending messages electronically, via computers that can communicate with each other.

ELECTRONIC SPREADSHEET An *interactive* computer program that allows the user to use the CRT as a spreadsheet. The program provides a grid of columns and rows. The relationships between the data to be entered in the columns and the rows can be specified by the user. The program then manipulates the columns and rows of numbers automatically. If one number is changed, all other related numbers are automatically changed. Spreadsheet programs thus require the user to do a fair amount of preliminary work. Templates are available for some spreadsheet programs. See Templates.

ERGONOMICS The scientific study of the relationship between human beings and machine and the effects of this relationship on human performance. Also known as human factors engineering.

EXECUTE To carry out the instructions in a program, i.e., to run the program.

FACSIMILE A process whereby images are transmitted electronically, usually over some distance. The image is scanned, converted into digital signals, sent via a communications line, and reconstructed as a duplicate of the original image at the receiving station. Sometimes called fax.

FIELD A sub-division of a record, i.e., a group of one or more related characters and/or numbers stored in a computer record. A record will have several fields, e.g., name, address, postal code, and telephone number can be fields in a record. See also Data Base.

FIELD UPGRADABLE Refers to a piece of computer hardware or software that can be upgraded at the customer's site without being physically replaced. (Equipment that is not field-upgradable usually has to be disposed of, and completely new equipment has to be purchased to replace it.)

FILE A file consists of a collection of related records, e.g., an employee file has a record for each employee. See also Data Base.

FILE MANAGER see Data Base Package.

FLOPPY DISK see Diskette.

FLOWCHART A pictorial representation of the steps in a program, or of a solution to a problem.

FONT A set of printing type in one particular style (e.g., Helvetica, Pica, Executive, etc.) and size.

FORTRAN (FORMULA TRANSLATOR) An early high-level computer language still in wide use, particularly for mathematical, scientific and engineering applications.

FUNCTION KEY A key that causes the computer to perform a predetermined function, e.g., Help, Delete, etc.

FUNCTIONAL PACKAGE Refers to packaged programs that carry out organizational functions, e.g., the accounting and payroll functions. Such packages are often designed to meet the needs of a particular "sector", e.g., local government, automobile dealers, fast food restaurants, etc. (Packages designed for particular industrial sectors are sometimes called vertical market packages.) Contrast with Generic Package.

FUNCTIONALITY see Capability.

GENERIC PACKAGE Refers to packages that can be used by *any* organization of any size, in any industry, e.g., electronic spreadsheet or word processing packages. These packages are sometimes called personal productivity tools or horizontal market packages, i.e., they fit into any industry. Contrast with Functional Package.

HARD COPY A record of computer output printed on paper.

HARD DISK A disk made of aluminum and covered with magnetic metal oxide, capable of storing 5 million bytes or more, sealed in plastic to protect it from dust. Most hard disks cannot be removed from the disk drive, but removable disks are becoming more common. Often called a Winchester disk.

HARDWARE The physical pieces of computer equipment.

HEAD see Read-Write Head.

HEAD CRASH When a read/write head touches a disk spinning at high speed and destroys the data. Usually the result of the head becoming misaligned or a power failure.

HEXADECIMAL A numbering system that uses 16 as its base of input values. (The decimal system uses base 10.)

HIGH-LEVEL LANGUAGES Programming languages that resemble ordinary English. A single instruction in a high-level source language translates into many machine-language instructions.

INFO GLOBE A data bank owned by the *Globe and Mail* that contains articles reported in that newspaper. It is accessible on-line to subscribers.

INFORMATION Any data that can be coded for processing; data organized in a meaningful manner that meets a user's needs.

INPUT As a noun, input refers to data that will be processed by the computer. As a verb, to input means to enter data into the computer.

INPUT/OUTPUT DEVICE (I/O DEVICE) A piece of equipment that feeds data into or takes results from the computer. CRTs and keyboards are input devices; printers are output devices.

INQUIRY A request for information that is stored in the computer's memory.

INQUIRY PACKAGE see Data Base Package.

INSTALLATION A collective name for the hardware, software and other computer-related facilities in an organization. Installing the computer means setting it up in a user location.

INSTRUCTION One line of coding in a program, e.g., Add A and B; telling the computer what to do next.

INSTRUCTION SET All the types of instructions that a computer is capable of carrying out. The computer combines these instructions in different ways to carry out major tasks.

INTEGRATED Applications are said to be integrated if they use common commands and/or common data, or if some of the output of one application is automatically used as input to another. See also Data Base.

INTEGRATED GENERIC PACKAGES Software packages that combine several applications. They are capable of carrying out several different tasks using common data. For example, an integrated package may combine a spreadsheet, a graphics program and a data base utility. The output from one task, e.g., numbers produced by the spreadsheet part of the program, is used to carry out another task, e.g., producing graphics.

INTEGRITY The soundness or unimpaired condition of something. For example, the integrity of a computer file refers to its records and data elements being error-free and complete. (Integrity is thus a condition that must be maintained.)

INTERACTIVE A mode of processing that allows the user and the computer to "communicate" with each other. For example, the computer displays a question on the screen, and the user keys in a response, which in turn causes the computer to do something.

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INTERFACE A place or point at which two systems meet; in computers, an electronic connection between two computer devices, enabling them to communicate. (This kind of interface is also called a port. See Port.) Also used as a verb to refer broadly to the ability of one thing to interact with another.

I/O DEVICE see Input/Output Device.

K (KILO) Stands for about one thousand units. (Strictly, 1,024 or 2 to the power of 10.) Thus 64K = 65,536. 64 Kilobytes is written as 64 K bytes or 64KB.

KEYBOARD A piece of equipment that has keys resembling those of a typewriter, used for entering data.

KEYING The process of using a keyboard to enter data into the computer. Comparable to typing.

KEYWORD One of the significant and informative words in a title or document that describes the content of that document.

LAN see Local Area Network.

LETTER-QUALITY PRINTER A printer that produces fully formed letters, similar to those produced on a typewriter. Compare with Dot-Matrix Printer.

LIBRARY A collection of programs used by an organization.

LOAD To read a program from an external storage device (e.g., a diskette) into the computer's main memory for execution.

LOCAL AREA NETWORK (LAN) A system that allows computers within a local area (e.g., a single building) to be linked, so that they can share peripherals such as printers and disks, as well as data and programs. LANs can be configured in several different ways. A network controller keeps order.

LOGON To identify oneself to the computer. A set of procedures that the user must follow in order to gain access to the CPU. For example, it is usual to enter the user's identification code, called the ID or user id, and possibly a password.

LOW-LEVEL LANGUAGES These programming languages are in a form that requires little or no translation by the machine, e.g., assembler language. In contrast to high-level languages.

LPM (LINES PER MINUTE) A means of measuring the speed of a high-speed printer which prints an entire line at a time (e.g., 200 to 2,000 lpm). Compare with CPS.

M (MEGA) About one million. A 20-megabyte disk stores about 20 million characters or bytes. 20 million bytes is abbreviated as 20 MB.

MACHINE LANGUAGE A binary code that is the computer's native language and therefore requires no intermediate translation.

MAGNETIC DISK see Diskette; Hard Disk.

MAGNETIC TAPE A medium upon which data are recorded by means of magnetic dots. Records are stored and read in sequence, i.e., they cannot be accessed directly. See Sequential Access and Random Access.

MAIN MEMORY see Memory.

MAINFRAME A very large computer.

MAINTENANCE Maintenance is used to refer to computer hardware and software. *Hardware* maintenance for micro-computers is usually 'remedial', i.e., the computer is repaired when it fails, as opposed to preventive (equipment is serviced at regular intervals). *Software* maintenance usually refers to minor modifications of functional programs to accommodate changes in applications.

MANAGEMENT INFORMATION SYSTEM An integrated series of programs and data files designed to meet most or all of the information needs of a particular functional area of the organization, or of the entire organization. Compare with Decision Support System.

MASS STORAGE The term used to refer to the devices (disks or tapes) for storing large amounts of data.

MEMORY Usually refers to the main memory, or RAM, of the computer, i.e., the device that stores data and programs, allowing them to be executed by the CPU. Sometimes memory refers to the auxiliary memory of the computer, i.e., disk or tape which is used for mass storage. See also RAM, ROM, Mass Storage.

MENU A list of options (programs, or parts of programs, or records) which the computer displays on the screen. The user can choose the desired option to carry out a function or to retrieve some information. Menus tend to make the system user friendly for a new operator.

MERGE To combine items from two or more sets of information into a single set.

MICRO Used as a shortform for microcomputer.

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MICROCOMPUTER A small computer with a microprocessor as its CPU and its major circuitry on chips.

MICROGRAPHICS The collective name for the photographic techniques of producing records in miniaturized form, e.g., microfiche, microfilm.

MICROPROCESSOR The central processing unit of a microcomputer.

MIGRATION PATH A series of options offered by a computer manufacturer for upgrading an existing computer system.

MINICOMPUTERS A class of computers that have more processing power and memory than microcomputers but less than mainframes.

MIS see Management Information System.

MODEM (*MO*DULATOR/*DEMO*DULATOR) A device that allows computers to communicate with each other using telephone lines by converting the digital signals of a computer into the analog signals of a telephone line and vice versa.

MONITOR Another name for a CRT.

MS-DOS Disk Operating System produced by Microsoft Inc. for 16-bit microcomputers.

MULTI-PROCESSING/MULTI-PROGRAMMING/ MULTI-TASKING These three terms tend to be used interchangeably. There is no universally accepted definition for them. If a computer salesperson uses one of these terms, find out whether he or she is referring to:

- A machine that has more than one *processor* (this is the most common meaning of "multi-processing"). The number of processors has no bearing on how many applications can be run at the same time.
- A machine that can run more than one application program virtually simultaneously (it could have one or more processors). This is the most common meaning of "multi-programming".
- A machine that can accept keyboard input while printing output from a previously executed program (spooling). This is a specific version of multi-programming.
- A machine that can simultaneously execute two tasks within a *single* program. This is the most common meaning of "multi-tasking".
- Some other capability.

MULTI-USER Refers to a computer that is capable of accommodating more than one operator using the computer simultaneously. Such a computer may have only one processor but several terminals (CRTs and keyboards) and use of multi-tasking, multi-programming or multi-processing operating system.

NETWORK A group of computers and terminals linked to each other by co-axial cables or telephone lines. The network enables computers to send and receive data and to share some devices, e.g., printers and disk drives, with each other. See also Local Area Network.

OEM (ORIGINAL EQUIPMENT MANUFACTURER) A company that buys hardware (it does not manufacture the hardware, even though the name suggests this), writes application software, and then sells the hardware and the software as a complete system. Sometimes called a system house.

OFFICE MICROCOMPUTER Refers to the equipment used by the small organization as its sole computer resource.

OFF-LINE Not communicating directly with the computer. A mode of processing that involves an intermediate step before the data is entered into the computer. For example, data may be keyed onto a diskette (off-line). Some time later, the diskette is put on the computer for reading and processing. In a microcomputer that has a hard disk, data and text can be transferred from the hard disk to a floppy disk for storage purposes. Thus the data or text are stored off-line.

ON-LINE Communicating directly with the computer and under the control of the CPU and a program. A mode of processing that permits data to be entered directly to the computer, changing the data base immediately. Similarly, information is received immediately from the computer. Anything that is stored on a hard disk in a computer system is stored on-line.

ON SITE At your location, e.g., training or maintenance may be conducted on site.

OPERATING (OR SYSTEM) SOFTWARE The programs that are necessary to keep the computer running as automatically as possible. They do not actually process anything — that is the job of applications software — but they monitor and perform many operations at speed far beyond the capabilities of a human operator.

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OPERATING SYSTEM A group of programs that, among other things, control the computer's internal operations and input/output devices, interpret programs, interface the data from application programs to the hardware and schedule hardware resources.

OPERATOR The person who operates the computer, looks after libraries of files and programs, and checks paper or other input/output media. In the case of microcomputers, the operator may also be the user, i.e., the person who inputs data and makes use of the microcomputer's output to do his or her job.

OPERATOR MANUAL Written instructions for the person who actually operates the computer.

OUTPUT The result of processing data. Output may be in machine-readable form, such as magnetic tapes or disks, or may be in human-readable form, such as computer print-outs or displays on the CRT.

PACKAGE A program or set of programs, available from the computer manufacturer or a software company, designed to process a particular type of application. Since software packages are "pre-programmed", they can save a tremendous amount of time and effort in design, programming, testing and documentation. But since they are standard (i.e., designed to meet the common or usual requirements), they may not do exactly what a particular user wants. To be truly considered a package, the program must have been thoroughly tested and debugged. It should also be capable of being used without major alteration by a class of users, and should be properly documented. To be considered a *proven* package, the package should be successfully installed at two or more user sites. A *base* package is a standard package that can be modified more or less extensively to meet a particular user's requirements. (The package is written with the intention of being used in this way.) See also Functional Package, Generic Package.

PARALLEL CONVERSION A parallel conversion is one in which the old system is maintained while the new, computerized system is being installed and tested, to verify that the new system is producing the results it is supposed to produce.

PASCAL A high-level programming language used for business and scientific programs.

PASSWORD A secret set of characters that should be known only to authorized people. The password must be entered before access can be gained to the computer.

PERIPHERALS (OR PERIPHERAL DEVICES) A collective name for the equipment that is attached to the computer to perform input, output or storage functions, e.g., keyboards, CRTs, disk drives, printers. The peripherals are external to the CPU and main memory but are under CPU's control to a lesser or greater degree.

PERSONAL COMPUTER In the early days of microcomputer technology, microcomputers had very limited power. They were expected primarily to be used by and to serve the needs of one person, hence the term 'personal computer'. Microcomputers are still used to meet the needs of one person, but so-called personal computers are now powerful enough to be used as the sole computer resource for a small organization. Contrast with Personal Productivity Tool.

PERSONAL PRODUCTIVITY TOOL Refers to the use of a microcomputer to increase the productivity of one individual, e.g., running a spreadsheet program, in contrast with using the computer to carry out corporate functions such as accounting.

PIRATE To give away or sell copies of software products without paying the producer or the licensed distributor of the product. Piracy is illegal. In contrast, programs in the public domain may generally be freely copied.

PIXEL Abbreviation of *p*icture *el*ement. A pixel is a small dot of light used on the CRT's screen to form images. The greater the number of pixels, the higher the resolution of the image.

PL/1 (PROGRAMMING LANGUAGE #1) A compiled programming language developed by IBM for mainframe computers.

PLOTTER A device that draws graphs, pictures or schematics. The pen or other drawing instrument operates under the control of the computer.

PLUG COMPATIBLE The ability of one device to link directly with another without any alterations to either device. (First-time computer users should be extremely cautious about vendor claims of hardware (or software) compatibility.)

PORT Ports (or interfaces) allow data to pass to and from the computer and its peripherals. Externally, the port takes the form of a sophisticated electrical plug, with several pins, which connects the peripheral's cable to the computer unit. Internally, the port's cir-

cuits record the signals so that the receiving or sending element can understand them. The RS 232 *serial* port is the most common form of interface. There are also *parallel* ports.

PORTABILITY The ability of a program to be used on different makes of computer.

PRINTER A peripheral device that converts coded data into printed form, thus functioning as a robot typist. See also Dot-matrix printer; Letter-quality printer; CPS; LPM.

PROCESSING A series of actions or operations intended to produce a result. A computer processes data in accordance with programmed instructions.

PROGRAM A set of instructions directing the computer to perform a task. The normal sequence of instructions is the following: read information; process it (add, subtract, etc.); update existing files with new information; and output (display, print or store) information. Also used as a verb meaning to compose such a set of instructions.

PROGRAMMER A person who writes a program in the code of a particular programming language. In doing so, the programmer translates input and output requests, logic flows and calculations into a set of computer instructions.

PROGRAMMING LANGUAGE A systematic code used for writing the instructions that together make up a program. BASIC, FORTRAN, COBOL and PASCAL are examples of widely used programming languages, each with its own symbols, "grammar", spelling rules, and so on. Languages come in different versions. Thus, BASICA is similar, but not identical, to BASIC.

PROTOCOL A set of rules, formats and practices governing data communications between computers and terminals. Protocols determine such things as how to verify accuracy, and address messages, as well as the number and types of information and devices that can communicate.

PULSE An electrical signal, the presence or absence of which represents data to a computer.

PURGE To remove unwanted data or data files. For example, draft documents are usually purged from the computer storage medium after the final document has been approved.

RAM (RANDOM ACCESS MEMORY) The main, internal memory of the computer, into which programs and data are entered for processing during the actual execution of the program(s).

RANDOM ACCESS (or DIRECT ACCESS) A method of accessing that allows the computer to go directly to a stored data record without having to read an entire disk or tape. (Compare with Sequential Access.)

RANDOM ACCESS MEMORY see RAM.

READ A computer "reads" data by sensing the magnetized dots on a disk or diskette, or the electrical pulses on a communication line.

READ-WRITE HEAD Part of the disk drive that reads and writes on the concentric tracks of a disk.

RECORD A collection of related data items; a logical bit of information concerning a unique entity. Each record usually has a unique identifier, or key, by which the system can identify it. See also Data Base.

RECOVERY The re-starting of a system after it has been out of action as a result of a malfunction or an error condition.

RESPONSE TIME The interval between entering data into a computer and receiving a response.

RFP (REQUEST FOR PROPOSAL) A formal document requesting vendors to submit proposed solutions to an organization's (computer) requirements. May also be called an RFQ (Request for Quotation).

RICHNESS OF FUNCTION see Capability.

RISK The potential loss or damage to an organization that could occur if a computer system does not function properly or is misused.

ROM (READ ONLY MEMORY) An internal memory holding permanent instructions for the computer; not changeable by the user.

RPG (REPORT PROGRAM GENERATOR) A high-level programming language used for business applications, particularly to format and print the results of data-processing programs.

RUN The series of activities that the computer carries out to complete a processing task.

SAVE A command that tells the computer to store data or programs that are to be used again.

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SCREEN The television-like screen of a CRT.

SCROLL To move data or the cursor up or down on a screen.

SECURITY Refers to protecting the microcomputer hardware, software and documentation from theft, misuse or physical damage, as well as safeguarding the information that is stored and processed by the computer. Information must be protected against unauthorized access, modification or destruction.

SEQUENTIAL ACCESS A method of accessing that obliges the computer to read all the stored data in sequence, until it reaches the required data record. Records are also placed into storage in the computer in a specific sequential order.

SERVICE BUREAU A service bureau is a facility that provides processing, programming, or other services to people beyond the organization that owns the facility. Thus it includes organizations that are solely in the computing business, commercial enterprises that charge outsiders for the use of excess capacity, or government agencies that permit others to use programs and/or computers.

SINGLE TERMINAL see Terminal.

SMALL BUSINESS COMPUTER A microcomputer or a minicomputer capable of performing as a small organization's central computer.

SOFTWARE A generic name for computer programs and their supporting documentation. See also Applications Software and Operation Software.

SORT To arrange records in a particular sequence, e.g., by date due, by amount owed, etc.

SPOOLING (SIMULTANEOUS PERIPHERAL OPERATION ON-LINE) A technique whereby output data to be printed are temporarily saved on disk. The operator instructs the printer to start printing once the processing has been completed, and can carry on with other tasks using the microprocessor while the output is being run off on the printer. Spooling allows two or more users to request the use of the printer simultaneously without having to wait for each print program to execute completely in turn.

STAND-ALONE Refers to a computer (or some other type of equipment such as a word processor) that functions independently as a self-sufficient unit. A stand-alone computer is thus not linked to any other computer or to any network.

STOCK TAB Continuous-feed paper for everyday use on a printer. The paper has no letterhead or special columns, etc.

STORAGE Storage is the physical means of storing data and programs, either in the main computer or on auxiliary devices. Storage media include paper tapes, and magnetic tapes and disks.

STREAMER TAPE A magnetic tape used for backing up a hard disk. The technique of streaming speeds up the transfer of data by eliminating gaps between blocks of data that occur with other recording methods. A streamer tape is a faster and more reliable means of backing up a hard disk than ordinary audio cassette tapes.

SYSTEM A system in general means a group of related activities. Here it is usually used as a short form for "computer system". Depending on context, it refers to the combination of hardware that constitutes a particular configuration, or an application that uses the computer as part of the overall system, or the hardware and software together.

SYSTEMS ANALYSIS The analysis of an activity or series of activities to determine exactly what must be accomplished and how to accomplish it.

TAPE see Magnetic Tape.

TELECOMMUNICATION The transmission of data between computer devices over long distances, usually via telephone lines.

TEMPLATE Two types of templates are available with some application packages. A keyboard template, made of cardboard or plastic, can be fitted over the keyboard. The template shows which keys do what when the application is being run on the computer. The second type of template may be part of a computer program or it may be available on a separate diskette or as a book. It sets out the steps to be followed when using interactive programs such as spreadsheets or data bases, in order to achieve a particular result, e.g., you can produce an annual budget using a budget template for a spreadsheet package.

TERMINAL A generic name for any piece of equipment that enables people to communicate with a computer, either directly or from a remote location. Thus terminals are input/output devices. 'Terminal' is used to refer to the CRT and the keyboard considered together; however, a terminal could also consist of a

keyboard and a printer. A computer may have a single terminal (one CRT and one keyboard) or two or more terminals, i.e., it may be a multi-terminal computer. With only one terminal, the computer can obviously be used by only one person at a time. A computer could be linked to a mainframe, in which case the computer's terminal serves both as a terminal to the mainframe and as a terminal to the computer itself.

THROUGHPUT The amount of information that a computer can process in a given time. One way of measuring a computer's capacity (e.g., this computer's throughput is 200 labels per hour).

TRACK A concentric ring on a disk. Data are stored on the disk in concentric rings or tracks.

TURNKEY Used to refer to a system installed by a vendor for which the purchaser has only to "turn the key"; a system that theoretically, at least, requires no further modifications or programming by the user.

TUTORIAL DISKETTE A diskette that the user can sometimes obtain from a hardware or software vendor which explains how to use the equipment or the program. It is intended for self-study.

UPDATE The addition to, deletion of, or change to data that brings the data or program up to date. (Used as a noun or verb.)

UPGRADE To enhance or expand a computer installation. In contrast with a conversion, the existing facility itself is not altered. Instead, a disk drive or other components may be added. Upgrading software means adding new features to the software. As a noun 'upgrade' refers to the enhancement itself.

USER FRIENDLY Used to describe hardware or software that people who are not data processing professionals will supposedly find easy to learn. 'User friendly' software, for example, might include menus of options, prompts, help features and so on. The commands are self-explanatory, e.g., Save.

USER MANUAL A documented description of a system or application together with instructions so that users can work with it. User manuals should describe all the non-computer activities as well as how to use the equipment, handle the input/output devices and run the programs. They should also contain samples of forms.

USERS The people who make use of the computer system to carry out functions for which they are responsible. The user may also be the operator.

UTILITY PROGRAM Frequently used, special-purpose programs usually supplied by the system vendor. Utility programs edit data, diagnose problems, manipulate files, etc.

VENDOR (Computer) The salesperson, or organization he or she represents, who sells computer hardware or software or both.

VERTICAL MARKET PACKAGE see Functional Package.

VDT (VIDEO DISPLAY TERMINAL) see CRT.

VDU (VIDEO DISPLAY UNIT) see CRT.

VOLATILE MEMORY Memory that does not retain its contents when the computer is turned off, i.e., RAM. "Permanent" or non-volatile memory does retain its contents, e.g., ROM.

WINCHESTER DISK see Hard Disk.

WINDOW A segment of the CRT screen used to display information independently of the display on the rest of the screen. (The effect is analogous to TV programs where a split screen shows the viewer two or more separate pictures at the same time.) The isolated segment of the screen is considered to be a "window" into the computer's memory.

WORD Used in connection with computers, a 'word' refers to the "column" or "package" of data that the CPU handles as a single logical unit. A word has a fixed number of bits. Early microprocessors handled 8 bits of data at a time. A microcomputer with this word size thus has an 8-bit processor. The newer machines have 16- or 32-bit microprocessors. Since they "think about" and move data around in larger chunks, they are usually faster and more powerful than 8-bit microprocessors.

WORD PROCESSING The computerized entry, processing and output of text. The text can be readily rearranged and corrected. Word processing can be done on a computer using a word processing package, or on a dedicated word processor. The latter equipment, unlike a general-purpose computer, is specifically designed to process text (i.e., it has special features on the keyboard, screen and in the software).

WRITE The computer or an output device writes a record by magnetizing dots in a coded pattern. It works in much the same way as a tape recorder. Writing is the process by which information is copied from RAM onto a storage device (disk, diskette or tape) or output device (display screen or printer).